Preamble
Alternatives Array Document
Winnebago Reclamation Landfill (WRL)
Pagel's Pit Site

The attached Alternatives Array Document (AAD), dated September 1990, has been prepared by Warzyn Engineering Inc. (Warzyn) for the Respondents Steering Committee. It has been submitted to the U.S. Environmental Protection Agency (USEPA) so that the Superfund Program of USEPA can submit requests for the identification of possible applicable or relevant and appropriate requirements (ARARs) and advisories, criteria or guidance to-be-considered (TBCs) for the Pagel's Pit (Winnebago Reclamation Landfill) site (WRL site) using the document as the source of information on the site. After the submission of several versions, the USEPA still does not agree with the contents of the document that has been prepared. To prevent further delays in the project, the USEPA is using for the AAd the attached AAD with this Preamble that presents the positions that the Agency has on many of the items in the document where the Agency differs with Warzyn. The Preamble also presents comments and explanations for sections of the document where these are believed to be necessary. This preamble is now an integral part of the AAD being used by USEPA.

In the AAD prepared by Warzyn, generally disregard the distinction that is made between WRL-leachate affected wells and non-WRL-leachate affected wells for the groundwater monitoring wells at the WRL site. Some of the organic contaminants that are found in the groundwater beneath the WRL site may have come from the nearby, up-gradient Acme Solvent Reclaiming, Inc. (Acme Solvent) site. However, Warzyn has not proven that the Acme Solvent site is the sole source of these contaminants at the WRL site. With regard to the ambient or chemical-specific requirements and the location-specific requirements, the sources of the contaminants in the groundwater are generally not important in any case. The sources may become important when considering what remedial actions may be needed.

In line with the above, also generally disregard the use of "groundwater contamination attributable to WRL" and similar phrases. All groundwater contamination at the WRL site is of concern, even that which Warzyn claims cannot be attributed to WRL.

Section 2.1 and Figure 2. While Winnebago Reclamation Service, Inc. and possibly other companies associated with it may own all of the land within the boundaries shown on Figure 2, the land that has historically been associated with Pagel's Pit is only a part of the property. The practical property boundary does not extend across Killbuck Creek on the west and stops at Lindenwood Road on the east. On the north and the south it is generally within a few hundred feet of the approximate limits of the waste fill area.

Section 2.4. Warzyn has not yet supplied all of the information about the landfill that the Work Plan says is to be furnished with the report on the remedial investigation. Therefore, there is still much that has not been reported about the construction and operation of the landfill. It has not been shown that the existing landfill gas extraction system does now keep the landfill gas within the waste boundary. It has not been shown that the leachate extraction process has been preventing the buildup of an appreciable head of leachate in the landfill. It has not been shown why leachate has to be removed from the gas extraction wells as well as the leachate manholes.

Section 2.4. Figures 1-3, 1-9, 1-10, and 1-11 have not been included in this document.

Section 2.4. It is unclear what type of cover the landfill has received in the central and eastern two-thirds, whether it is a clay cover or the natural material consisting of clay mixed with bank run sand, limestone, or shotrock.

Section 3.1. The USEPA does not agree with many of the conclusions that Warzyn presented in the Interim Groundwater Quality Evaluation Report (March 1990) (Interim Report). Most of the disagreement is based upon the Agency's assertion that Warzyn has drawn conclusions that are not supported by the data. Primarily, this involves their conclusion that most, if not all, of the organic contamination at the WRL site comes from the Acme Solvent site despite the fact that the concentrations of many of these organic contaminates in the groundwater under parts of the WRL site are much higher than the concentrations in groundwater samples taken from monitoring wells between the two sites. Another point of difference concerns the chloride concentration in the groundwater that corresponds to the background level. It is the Agency's contention that this level is no greater than about 20 mg/l whereas Warzyn claims levels as high as 73 mg/l are background levels despite the fact that levels below this that are closest to it are found only in wells that are down gradient from the landfill wastes. The 73 mg/l of chloride is found in a well on the WRL site. What chloride level is the background level affects what wells are concluded to have been affected by leachate from the landfill or, possibly, by other sources of contamination at the WRL site.

Section 3.1.1 and Table 2. On page 8 of Table 2 are listed, apparently, the volatiles that were found in the leachate samples. Page 7 of this table is missing and therefore the listing of the volatiles is incomplete; some of the tentatively identified volatiles are also probably missing. From the draft report for the remedial investigation, the volatiles that have been found in the leachate are: chloromethane, vinyl chloride, chloroethane, methylene chloride, acetone, carbon disulfide, 1,1-dichloroethene, 1,1-dichloroethane, total 1,2-dichloroethene, chloroform, 2-butanone, 1,1,1-trichloroethane, 1,2-dichloropropane, trichloroethene, benzene, 4-methyl-2-pentanone, 2-hexanone, tetrachloroethene, toluene, chlorobenzene, ethylbenzene, styrene, total xylenes, trans-1,2-dichloroethene, cis-1,2-dichloroethene, 1,4-dichlorobenzene, m- and p-xylene, o-xylene, and 1,2-dichlorobenzene.

Section 3.1.2 and Table 3. Of the wells listed here, the Agency believes that wells P3R and G115 have been affected by leachate, as shown by their chloride concentrations.

Section 3.1.2 and Table 3A. Of the wells listed here, the Agency believes that well G116A has been affected by leachate, and well P4R has probably also been affected by leachate.

Section 3.1.2 and Tables 4 and 4A. Of course, the Agency believes that more wells on the WRL site than those listed have been affected by the leachate in the landfill or some other unnamed source at or very close to the site.

Section 3.1.2. Based upon the data from all four rounds and the locations of the monitoring wells, it is the Agency's contention that there is only one area where chloride concentrations now appear to be elevated. That is the area that extends from about well B15R on the north around the west side of the landfill to at least well G114 on the south side, but probably to well G109A also. This includes the areas that Warzyn lists. The data shows that the contaminated groundwater has passed under Killbuck Creek to at least well G116A.

Section 3.1.2, page 14. All organic compounds listed in Table 1 will be considered in the evaluation of remedial actions for the WRL site, not just the volatile organic compounds (VOCs) listed on page 14.

Section 3.1.2, pages 15 and 16. The discussion concerning the distribution of VOCs in the groundwater and the issue of landfill gas migration has generally no relevance to the concerns of this document. The source(s) of the contamination around wells G113A, G109A, and B13 has not definitely been determined by Warzyn; well G109A has a chloride level that is well above background, and wells G113A and B13 have chloride levels that are somewhat above what the Agency believes is background. However, since these wells are on the WRL site and near the waste area, the contamination in the groundwater there must be addressed.

Section 3.1.3. In the baseline risk assessment for a draft report for the remedial investigation, some contaminants are listed for Killbuck Creek and sediments from this creek. Chloroform is the only volatile listed for the sediments, and for the water, this compound and benzene, chloroethane, methylene chloride, 1,1,1-trichloroethane, and trichloroethene are listed. Bis(2-ethylhexyl)phthalate and di-n-butylphthalate are also listed for the sediments. Phenols have been detected in the water. Also in the water, barium, cadmium, chromium, and cyanide were detected. These inorganics were also detected in the sediment along with arsenic, manganese, nickel, thallium, vanadium, and zinc.

Section 3.1.4. Table 6 contains the data for this section.

Section 3.2. The data, even just the early rounds that were considered in the Interim Report, shows that the landfill is leaking at more than two locations.

Section 3.2. In the draft baseline risk assessment, it was determined that exposure associated with the groundwater plume results in noncarcinogenic health effects that may be of concern and cancer risks that would be substantially greater than the USEPA risk goal. The cancer risks are due to both metals and organics in the groundwater; the organics consist of more compounds than are listed on page 18 of the AAD.

Section 3.2. At the time the air data was taken, gas extraction was in place. The conclusion here that the air pathway does not have to be considered for risk assessment cannot be supported because no data has been presented to show that gas migration is under control.

Section 3.2. Killbuck Creek may have been affected by the contamination in the area.

Section 4.1. The first remedial action objective has to be: "minimize the potential risks associated with groundwater contamination;".

Section 4.1. Potential ARARs are listed in Table 7, not Table 1 as stated.

Section 4.1. The ARARs will be identified as the result of requests made with the submittal of this document to the State of Illinois and other programs at USEPA, not in the remedial investigation.

Bernard J. Schorle
Remedial Project Manager
U.S. Environmental Protection Agency
October 4, 1990

ALTERNATIVES ARRAY DOCUMENT

WINNEBAGO RECLAMATION LANDFILL (WRL)
WINNEBAGO COUNTY, ILLINOIS

Prepared for:

WRL RI/FS PRP GROUP

Prepared by:

WARZYN ENGINEERING INC.
Chicago, Illinois

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SECTION 1.0
INTRODUCTION

1.1 Authorization, Purpose, and Scope

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), has established a fund for the investigation and clean-up associated with uncontrolled hazardous waste sites. CERCLA requires the United States Environmental Protection Agency (U.S. EPA) to evaluate remedial activities, determine the appropriate extent of the activities, and select a remedial action that will be consistent with goals set forth in CERCLA Sec. 121. Such remedial measures must, to the extent practicable, be in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The U.S. EPA has authority and responsibility for carrying out these requirements under CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The provisions for enacting the requirements of CERCLA appear in the NCP (40 CFR 300).

After discovery of a possible uncontrolled site, a preliminary determination is made as to whether the site presents or may present a threat to the public health or the environment. If additional action is determined to be warranted, the U.S. EPA may place the site on the National Priorities List (NPL) of hazardous waste sites. Additional work may then be undertaken to better define potential problems, to develop and evaluate possible solutions (remedies) and to select an action based on the study results. This process for selection of remedial measures consists of the following four major elements:

- Remedial Investigation (RI) - During the RI, data are collected to define site conditions, including the extent of releases or threatened releases from the site and the characteristics of source materials. Data on releases are evaluated to assess the potential effects of releases on public health and the environment. A baseline risk assessment (BRA) is included in the RI.

- Feasibility Study (FS) - In the FS, a number of potential remedial alternatives are developed, evaluated against a range of factors set forth in the NCP, and compared against one another.

- Selection of Remedy - The U.S. EPA will indicate a preference for a particular remedial alternative, and prepare a Proposed Plan for the Site. The Proposed Plan highlights the RI/FS report, provides a brief analysis of remedial alternatives under consideration for a site or operable unit, identifies the preferred alternative, and provides the public with information on how they can participate in the remedy selection process. The Proposed Plan, together with the RI and FS reports and other documents considered during the remedy selection process, is placed in the administrative record for review and comment by the public.

- The U.S. EPA makes a final selection of the remedy for the Site after the public comments are reviewed, considered, and addressed. This selection is embodied in a record of decision (ROD), which discusses the remedy and rational for selection, and response to significant comments by members of the public and interested persons.

This Remedial Investigation/Feasibility Study is being conducted by Warzyn Engineering Inc. (Warzyn) of Addison, Illinois under contract with the Potentially Responsible Parties (PRPs) to perform RI/FS activities for the Winnebago Reclamation Landfill (WRL) Site. The RI element of the process is nearing completion. The FS element of the process has just begun. Typically, the FS may be viewed (for explanatory purposes) as occurring in three phases: the development of alternatives, the screening of the alternatives, and the detailed analysis of alternatives. This document is the first phase of the FS, development of alternatives which are being considered for the final remedial action.

The document has been prepared to provide a summary of WRL Site conditions based on information collected to date during the RI, and to describe the remedial alternatives developed based on this information.

1.2 Report Organization

Section 2.0 of this report provides background information about the WRL Site, including location, history of operations, and hydrogeology based on information developed during preparation of the Interim Groundwater Quality Evaluation report. More detailed information is presented in the Interim Groundwater Quality Evaluation Report (March 1990) and the RI Report. The nature and extent of the Site contamination identified during the RI are described in Section 3.0 of this report. A description and summary of the technology screening process presented in Section 4.0 is part of the FS element of the CERCLA process. Section 5.0 presents a description of alternatives developed by assembling a limited number of promising technologies identified in Section 4.0. These preliminary remedial action alternatives will be subjected to additional screening prior to the detailed evaluation phase of the FS. Potential applicable or relevant and appropriate requirements (ARARS) for the identified remedial alternatives are presented in Section 6.0.

SECTION 2.0
BACKGROUND INFORMATION

2.1 Site Location

The WRL Site, also known as the Pagel Landfill, is an active solid waste landfill licensed by the state of Illinois. The WRL Site is located in south central Winnebago County in north central Illinois, approximately 5 miles south of the city of Rockford, in a predominantly rural unincorporated area (Figure 1). The WRL Site is comprised of approximately 60 acres of land in the east central portion of Section 36, T43N, R1E and the west central portion of Section 31, T43N, R2E. The WRL Site is bounded on the west by Killbuck Creek and on the east by Lindenwood Road. Killbuck Creek, a perennial stream, merges with the Kishwaukee River about two miles northwest of the WRL Site.

The landfill is upland of wetland and floodplain areas of Killbuck Creek. Figure 2 shows wetland areas and 100-year flood boundaries along Killbuck Creek according to U.S. Department of the Interior and the Federal Emergency Management Agency respectively. The minimum elevation difference between the western boundary of the landfill and the 100-year flood boundary is 25 feet. Figure 2 also shows the approximate WRL property boundaries (based on WRL maps) and the limits of the Acme Solvents Reclaiming, Inc. site east of the WRL (Ecology and Environment, 1983).

2.2 Site Description

The WRL Site is located on a topographic high between Killbuck Creek to the west, and unnamed intermittent streams to the north and south (Figure 1). Killbuck Creek, a perennial stream, flows within 250 feet of the western WRL waste boundary and merges with the Kishwaukee River about two miles to the northwest. Surface topography of the Site consists primarily of an area of high relief resulting from the landfill waste disposal operations. The topography surrounding the landfill area is relatively flat to gently rolling. The ground surface ranges from elevation 790 ft mean sea level (MSL) on top of the landfill to 708 MSL in the floodplain of Killbuck Creek. A small leachate collection pond is located on top of the landfill.

2.3 Site History

The WRL Site has been in operation since 1972 with an estimated 5 to 6 years of capacity remaining. Wastes accepted at the WRL Site are composed primarily of municipal refuse and sewage treatment plant sludge. Prior to start-up of the sludge drying plant in January 1985, the landfill accepted wet sewage sludge. Only dried sludge has been placed since that time. A very limited amount of Illinois special non-municipal wastes were disposed of at the facility prior to December 1975 under permits issued by the IEPA. Not all of the special wastes permitted by the IEPA were actually disposed at the landfill (WRS, 1984).

In 1979, methane gas was detected at the landfill (Warzyn, 1980). NRG has indicated the following sequence of events were implemented to prevent further gas buildup and migration. The facility installed a gas extraction and collection system in March and April 1980. The system was located on the eastern side of the landfill, and consisted of five 4-inch PVC wells installed in the waste to within 3-feet of the base of the landfill. The wells were connected to a header pipe which was connected to a 750 cubic feet per minute (cfm) vacuum blower. Gas extracted from the landfill was flared directly to the atmosphere. The system was expanded between April and August 1980 to include four additional wells. In December 1984, a new gas extraction and collection system was installed to provide fuel to the sludge drying plant. The new system was comprised of 70 wells located throughout the non-active portion of the landfill. Following installation of the new system, the original 9 extraction wells were abandoned. Twenty-one additional wells were installed and connected to the system in November 1988. Two 800 cfm vacuum blowers are used to recover landfill gas.

East of the WRL Site, on an approximately 20-acre parcel, is the Acme Solvents NPL site, which is currently undergoing a Remedial Investigation. The Acme Solvents site was used for the disposal of drummed wastes into unlined lagoons and drum stockpiling. The wastes disposed of at the Acme Solvents site are generally undocumented, but are known to have included solvent still-bottom sludges, nonrecoverable solvents, paints and oils.

The IEPA indicates that four lagoons were actively used for the disposal of wastes at the Acme Solvents site. The IEPA also reported that 10,000 to 15,000 drums may have been present at the site when it closed. The total quantity of wastes disposed of at the Acme Solvents site during its operations is unknown (Ecology and Environment, 1983; Jordan, 1984). IEPA inspections in late 1972 and early 1973 indicated the wastes in solvent lagoons at the Acme Solvents site were not removed, but were covered with soil. It was also reported that an unknown number of on-site drums were crushed and buried, rather than removed (Ecology and Environment, 1983). Clean-up and removal of buried drums and contaminated soils from the Acme Solvents site began in August 1986.

2.4 Landfill Construction and Operation

Construction and operation of the Winnebago Reclamation Landfill was begun in 1972 on the site of a former sand and gravel quarry. The landfill was sequentially constructed and filled in several sections, with development occurring generally in an east to west direction. Quarrying operations continued on a limited basis in areas adjacent to the active sections of the landfill. Asphalt curbs and later, earthen berms were placed between the active landfill and quarry areas. In the first stage of construction for each section, crushed limestone gravel was graded and compacted to form the floor and sidewalls. Next, 2 inches of asphalt was laid over the floor and sidewalls and compacted. The floor of the asphalt liner was graded to drain to various manholes placed throughout the landfill. Following installation of the asphalt liner, the floor and sidewall surfaces were sealed with one layer of emulsified asphalt and two layers of cationic coal tar sealer. The finished sidewalls are approximately 35 feet high and are sloped at a 3:1 ratio. The sealed asphalt liner was then covered with 8 inches of sand. A leachate collection system consisting of a network of 6-inch diameter perforated pipe was laid in the sand and connected to the manholes. The pipe itself is surrounded by 1 inch diameter washed aggregate. In some areas of the landfill, automobile tires were placed on top of the sand layer as additional protection for the leachate collection system and liner. Figure 1-10 shows a typical cross-section of the landfill base and waste fill cells.

As verified by site observations, access to the WRL Site for waste disposal is restricted by an 8-foot high chain link fence extending from the access road westward approximately 1,200 feet and eastward wrapping around the east end of the landfill adjacent to Lindenwood Road for approximately 2,500 feet (Figure 1-3). Access to the Site beyond the extent of the chain link fence is limited by topography (steep slopes and a heavily wooded area) along the southwest quarter and western side of the Site, and a three-strand barbed wire fence along the northwestern and southeastern portions of the Site.

Waste to be disposed at the WRL Site is weighed and transported through a gated entrance that is manned during daily hours of operation. Gate personnel record the weight, waste type, customer name and number. After acceptance of the load, the hauler is directed along internal access roads to the work face of the landfill where the waste is unloaded. The operator at the working face verifies the waste type with the sales ticket and reports any discrepancies to the gate personnel. The waste is dumped off at the top of the working face and pushed downward. The waste is compacted on the working face in 1 to 2 foot lifts using either a wheeled or tracked vehicle. The waste is covered with a 6-inch layer of soil daily. Cells are approximately 10 to 15 feet thick. When a particular area has been filled to an intermediate planned elevation and will not be receiving waste for sixty days, it is covered with 2 feet of natural material consisting of clay mixed with bank run sand, limestone or shotrock. After regular hours of operation, the gate is monitored by video camera and by the operator at the sludge drying plant to allow for sewage sludge delivery 24 hours a day. The scale is equipped with an alarm to alert the operator of any unauthorized entrance through the gate. Another chain link fence gate is located in the southeastern portion of the Site just off of Lindenwood Road. This gate is not monitored but is chained and padlocked. Winnebago Reclamation Service is planning to electronically monitor this gate in the near future.

The most current topographic map (April 26, 1990) of the landfill surface shows a top elevation of approximately 775 MSL at the western end and 790 MSL at the eastern end. The central and eastern two-thirds of the landfill have received the 2-foot thick clay cover, topsoil, and are covered with grass. Plans to complete filling of landfill include filling the eastern area of the landfill to 790 MSL and then filling over the entire surface area to a final top grade of 820 MSL. Current (April 1990) and proposed final grades are shown on Figures 1-9 and 1-10.

A gas extraction and collection system has been operating since 1980, and currently consists of 91 wells (Figure 1-11). The wells, which have been installed into the waste, range in depth from 19 to 63 feet. These wells are typically constructed of 6 or 8-inch diameter perforated Schedule-40 PVC pipe with a solvent-welded Schedule-80 coupling at each joint. The boreholes are 3 feet in diameter and backfilled with 1 to 1.5-inch diameter washed gravel. A 2-foot clay-bentonite seal is placed above the perforated sections, with the remaining annular space filled with cohesive material. The NRG plant operations manager has indicated that only the most recently installed wells (rows L, M, and N) will be retained upon final covering of the landfill. All remaining wells will be replaced. The wells are connected to a header pipe and the gas is drawn out of the fill using two of three available 800 cfm vacuum blowers. The collected gas is used as a fuel source for the sewage sludge drying plant. The blowers operate 24 hours a day, 365 days a year, with the exception of five holidays and maintenance downtime. If no sludge is available to be dried, the gas is burned in the dryer or diverted and burned at a common flare on top of the landfill. The gas extraction and collection system will be expanded to include the western area of the landfill as the active portions reach capacity and receive final cover.

Leachate is removed from the landfill by periodically pumping from both the leachate manholes and the gas extraction wells. Mobile, submersible pumps are placed in the wells and manholes, and run until the well or manhole is drained. When a given well is run dry, the associated pump is moved to a new location. The number of pumps employed and frequency of pumping have varied over the life of the landfill. The current system employs six 4-inch diameter submersible pumps. The pumps are run for approximately one hour each day, at a flow rate of 8 to 10 gallons per minute (gpm) each. Collected leachate is either pumped into the small pond at the top of the landfill or is recirculated by spraying over active waste areas. Leachate stored in the small pond is mechanically aerated and is then either sprayed over the active waste area or alternatively pumped into tank trucks and transported to the RVWRD City of Rockford sewage treatment plant. Leachate is not sprayed over areas which have received intermediate cover material. The quantities of leachate recycled and transported to the POTW vary from year to year. No records are kept for the recycling operation.

2.5 Regional Geology

The surficial unconsolidated materials of the area are predominantly glacial drift deposits consisting of ice and water-lain materials. Beneath and east of the WRL Site are the poorly sorted sand and gravel ice contact deposits of the Wasco Member of the Henry Formation. West, in the Killbuck Creek Valley, and north of the WRL Site are the sand and gravel outwash deposits of the Mackinaw Member of the Henry Formation. The surficial deposits south of the WRL Site are a silty clay till classified as the Esmond Member of the Glasford Formation.

The unconsolidated materials in the region are underlain unconformably by the rocks of Ordovician, Cambrian, and Precambrian Age. The Galena Group of the Ordovician System dominates the bedrock surface in the region. The Galena Group is underlain by the Platteville Group and both are primarily composed of carbonate rocks (90%). The Galena and Platteville Groups are underlain by the Ancell Group (Ordovician) which consists of two formations, the Glenwood and the St. Peter. The Glenwood Formation is comprised of interbedded dolomite, sandstone, and shale. The St. Peter is a fine to coarse grained sandstone. Below the Ancell Group is the Cambrian System consisting of sandstone., dolomite and shale., which is in turn underlain by Precambrian granite (Berg, et al. 1984; Willman and Kolata, 1978).

2.6 Site Geology

The thickness of the unconsolidated materials range from eight feet (B4) at the Acme Solvents site (bedrock exposed in places according to Jordan, 1984) and thickening westward to greater than 70 feet (P4R) at the western boundary of the WRL Site, filling the deep bedrock valley. The unconsolidated materials are predominantly sand and gravel deposits with a thin silt or clay layer near the ground surface. Basal portions of the sand and gravel were sometimes recognized as weathered bedrock.

The bedrock surface is highly variable due to paleoerosional features. A bedrock valley is present beneath the WRL Site, deepening westward. The bedrock is composed of Galena and Platteville Groups. These are predominantly dolomite with chert layers or nodules common. The dolomite was generally fractured throughout the total depth sampled. No trends in this fracturing have been identified. The fractures are predominantly bedding planes, frequently cross-cut by high angle or vertical fractures. Vugs (void spaces) are consistently found throughout the dolomite, but cavernous zones were not noted.

2.7 Hydrogeology

The water table occurs in the fractured dolomite east and below the eastern quarter of the WRL Site. In the remaining three quarters and west of the WRL Site, the water table occurs in the unconsolidated sediments. The water table also occurs in the silty clay till to the south of the WRL Site, but the sand and gravel beneath the till appears to be under semi-confined conditions. Groundwater flows from the bedrock uplands east of the WRL Site to the Killbuck Creek Valley. The water table in the bedrock upland slopes to the west, northwest, and southwest from a generally east-west trending groundwater "high" (or divide), appearing to be a subdued expression of the bedrock topography. This indicates that the bedrock topography may be a factor in controlling the water table configuration where the water table occurs in the bedrock. Where the water table occurs in the unconsolidated materials, the hydraulic gradient decreases and flow converges toward Killbuck Creek.

The presence of groundwater mounds have been noted in the vicinity of wells B4 and B7 and have been attributed to higher localized recharge rates induced by flow in the intermittent stream over highly weathered bedrock. This adds to the complexity of the fractured rock flow system. Water level data from wells screened in the bedrock have exhibited anomalous behavior, which is thought to be due to preferential groundwater flow through the variably fractured dolomite (Warzyn, 1990; Hickok, 1985; Herzog et al., 1988; Jordan 1986). Flow in fractured rock is analogous to flow in pipes, wherein the connected fractures are more important in determining flow paths than the hydraulic gradients. Hydraulic gradients are important in determining general groundwater flow direction, but specific groundwater flow paths are controlled by the permeability, with fractures presenting the paths of least resistance.

2.8 Surface Water Hydrology

There are unnamed intermittent streams to the north and south of the WRL Site. The northern stream joins Killbuck Creek about 1000 feet northwest of the WRL Site. The southern stream converges with Killbuck Creek about 1200 feet south of the WRL Site. Killbuck Creek, a perennial stream, flows within 250 feet of the western WRL Site boundary and merges with the Kishwaukee River about two miles to the northwest.

The average precipitation for the area is 33 inches per year; 66% being received between April and September, with an average snowfall of 33 inches. In winter, the average temperature is 23 degrees F and the average summer temperature is 71 degrees F (USDA, 1980).

SECTION 3.0
NATURE AND EXTENT OF PROBLEM

3.1 Summary of Remedial Investigation Results

Warzyn has completed the Interim Groundwater Quality Evaluation Report (March 1990) and has submitted the draft Remedial Investigation (RI) Report. The Interim Groundwater Quality Evaluation Report concludes that a VOC groundwater plume originating upgradient of the WRL Site has been overprinted by a largely inorganic leachate plume. The quality of the groundwater in the WRL site area, based upon four rounds of collected samples, is presented in Table 1. Constituents in the groundwater felt to be attributable to a background/upgradient source(s) are discussed in section 3.1.2 and presented in Tables 3, 3A, 4 and 4A.

The Phase I RI included soil sampling and rock coring of selected wells during the installation of 15 groundwater monitoring wells west of Lindenwood Road, and the collection and analysis of samples from the 15 new monitoring wells, 26 existing monitoring wells and one private well. Fifteen single-well field permeability tests were performed. Four rounds of leachate samples were collected and analyzed. Surface water and sediment samples were also collected from Killbuck Creek. Details of the investigation are contained in the Interim Groundwater Quality Evaluation Report. Geological and analytical data from other pertinent reports made available by the U.S. EPA have been evaluated and considered when appropriate.

3.1.1 WRL Leachate

The leachate samples (analyzed by GC/MS) generally contained higher concentrations of aromatic VOCs such as benzene, ethyl benzene, toluene, and xylenes than the chlorinated VOCs vinyl chloride and dichloroethene. Tetrachloroethene was detected only once and trichloroethene was not detected at all. Previous leachate sample results (Jordan 1984) generally follow these same concentration trends, indicating that the current leachate VOC composition is similar to the VOC makeup of leachate of 1984. It appears that the leachate composition has not changed significantly over this time span. The WRL Site leachate has a high inorganic component consistent with typical sanitary component leachates, except it has higher than typical chloride and sodium content. Leachate quality data is presented in Table 2.

3.1.2 Groundwater

Since the WRL Site is consistently hydraulically downgradient of a potential source (Acme Solvents), it is apparent that groundwater chemistry is important in the process of distinguishing the possible impacts from each site. The high inorganic component in the WRL Site leachate is used to discriminate between affected and unaffected groundwater wells by leachate from the WRL Site. Affected and unaffected wells are distinguished on a trilinear plot of the major cations (calcium, magnesium, and sodium plus potassium (percent of meq/l)). The WRL leachate samples plot as a sodium plus potassium rich water, while upgradient or unaffected wells plot as magnesium and calcium rich, forming the end points of a continuum encompassing wells affected by WRL leachate. This approach has been used elsewhere to discriminate between contaminated and uncontaminated water samples (see Section 4.4.1 of the draft RI for further discussion). Further the strong positive correlation between sodium plus potassium and the chloride ion (r^2 = 0.998) and the large chloride concentration contrast between groundwater and WRL leachate, indicate that chloride can be used to discriminate between wells affected and unaffected by WRL leachate.

Site groundwater quality considered to be non-affected by the landfill leachate are presented in Tables 3 and 3A, Non-WRL Leachate Affected Wells. Groundwater quality considered to be affected by WRL leachate are presented in tables 4 and 4A, WRL-Leachate Affected Wells. Groundwater quality in the southeast corner of the site is presented in Table 5. A detailed discussion is presented in the Interim Groundwater Quality Evaluation Report.

Based upon the four rounds of groundwater data, there are three general areas where chloride concentrations appear to be elevated indicating the presence of leachate:

- northwest quadrant of the WRL Site;
- at well G110; and
- at wells G114 and G115 (during sampling rounds 3 and 4).

While monitoring wells G114 (along the southern landfill boundary east of well G110) and G115 (adjacent to the southwest corner of the landfill) exhibited low chloride concentrations during sampling rounds 1 and 2 (April and June 1988), they exhibited increased concentrations during sampling rounds 3 and 4 (February and April 1990).

Within the WRL leachate affected groundwater, the SDWA Primary Drinking Water standards were exceeded for only barium at wells MW106 and P1. SDWA secondary standards were exceeded for chloride (B15, B15R, and MW106), iron (MW106 and P1), and manganese (B15R, MW106, P1, P3R, and P4R). The secondary standards are based on aesthetic considerations only. VOCs, designated as hazardous substances in Table 302.4 of 40 CFR Part 302.4, which could potentially be attributed to WRL based upon any detection in the leachate and a leachate affected well are: 1,2 dichloropropane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, chlorobenzene, benzene, xylenes and toluene. None of these were present in samples from the furthest downgradient well G116A, indicating that these constituents are being attenuated to non-detectable levels during transport to G116A.

Samples from downgradient wells neighboring well G110 (wells B13 and P6) do not contain elevated chloride concentrations, indicating that any excursion of leachate in this area is quite limited. The chloride anomaly at G110 has been previously attributed to surficial leachate seeps along the southern slope of the landfill. It has also been determined that the leachate hauling trucks were loaded at the base on the slope near G110, and thus any spills having occurred during loading operations could have been a source of chlorides. Both of these conditions could have contributed to the presence of chlorides at well G110. The seeps are currently under control and leachate is now loaded on top of the landfill. However, chloride concentrations at well G110 have continually increased, indicating an influence of WRL leachate on the groundwater in this area.

Distribution of chlorinated ethenes in the groundwater form a different pattern than that of chlorides. VOCs are found both inside and outside (horizontally and vertically) of the chloride plume adjacent to the northwest quadrant of the WRL Site, indicating that the WRL leachate chloride plume is overprinting a pre-existing VOC plume. The highest concentrations of total chlorinated ethenes are found at monitoring well B4 on the Acme Solvents site with the second highest levels found just west of Lindenwood Road south of the WRL Site (for example wells G113A, G109A, B13). Both of these areas are upgradient of the WRL Site and not associated with elevated levels of chlorides, indicating WRL leachate is not the source of these VOCs. The highest concentrations of VOCs being found at monitoring well B4 is consistent with the disposal of large quantities of solvent wastes. The definition of the VOC plume downgradient from the Acme Solvents site is not complete. Given the history of waste filling and the high VOC concentration noted at B4, a larger plume is expected.

Factors which may be playing a role in the apparent distribution of VOCs in the groundwater are further discussed in the RI:

1) intermittent and spatially variable recharge from the unnamed intermittent stream could breakup the Acme Solvents VOC plume as modeled by Jordan (1984);

2) biodegradation may alter the pattern of VOCs in groundwater;

3) the pattern of VOCs may be an artifact of the current well placement in a fracture flow dominant aquifer (i.e., a higher density of wells are present in the area just west of Lindenwood Road south of WRL, increasing the chances of intercepting a VOC containing fracture); and

4) a second source of VOCs.

The issue of landfill gas migration as a potential source of VOCs in the groundwater just west of Lindenwood Road south of the WRL Site has been raised, but is not considered viable because:

- a previous study (Warzyn, 1980) found landfill gas to be migrating off-site, though migration was only found in the highly permeable unsaturated soils above bedrock, indicating that the gas was not in contact with the groundwater table present in bedrock in the vicinity;

- a gas extraction system has been in operation since 1980 controlling the landfill gas migration;

- the WRL leachate contains lower concentrations of VOCs than the groundwater samples from wells southeast of the WRL, indicating that it is unlikely that significant amounts of VOCs could be or were in the landfill gas; and
- the WRL generally accepted municipal wastes with limited quantities of Illinois Special Waste, and so would not be expected to be able to release significant amounts of VOCs, as would a solvent disposal site.

3.1.3 Subsurface Water and Sediment

There were no upstream/downstream trends in the results of the surface water or sediment samples. Results were either comparable to background or attributed to field/laboratory contamination. Results of surface water samples collected and analyzed by the USGS from a surface water monitoring station for Killbuck Creek downstream from the WRL Site at the bridge at state Highway 251 showed little correlation to the discharge rate of that stream. Comparison of the data from this investigation to the USGS data indicates that the results were similar in value. Since upstream/downstream trends in the Phase I results are not evident in the surface water samples from this study, and because there is little correlation between discharge and surface water quality as measured by the USGS, based on the available data, the WRL Site does not appear to be impacting the water or sediment quality of Killbuck Creek.

3.1.4 Air Quality

Six ambient air samples and one trip blank were collected at WRL on October 25, 1988. The samples were analyzed by Radian Corporation, and the results validated by Warzyn.

The data validation indicated that the data was of limited value due to exceeded hold times. Detection limits and concentrations were qualified as estimated. Some results were qualified due to compounds being present in the trip blank and method blanks. Other results were qualified due to instrument calibration criteria.

Fifteen compounds were validated as being present in the samples. Concentrations were calculated based on the volume of air sampled and reported in units of mg/m3. Concentrations ranged from 0.0000126 mg/m3 to 0.0597 mg/m3.

The validated detected compound concentrations (Table) were compared to the Threshold Limit Value-Time Weighted Averages (TLV-TWA Table) for 1989-1990 as adopted by the American Conference of Governmental Industrial Hygienists (ACGIH). The TLV-TWA is defined as the time weighted average concentration for a normal 8-hour workday and a 40-hour work week, to which nearly all workers can be repeatedly exposed, day after day, without adverse affect.

TLV-TWAs for these compounds range from 31 to 810 mg/m3. All compound concentrations are on the order of five or six magnitudes lower than the TLV-TWAs.

The National Ambient Air Quality Standards (NAAQS) were also reviewed. The only applicable standard is for hydrocarbons (non-methane), with a limit of 0.16 mg/m3. The total of the highest concentration for each compound regardless of location is 0.122 mg/m3, a value which is below the standard. Total concentration results for each sample are lower than this maximum value.

In summary, evaluation of this data indicates that the ambient air quality at WRL does not pose a health hazard based on the standards indicated.

3.2 Preliminary Health Risk Assessment

The purpose of this section is to characterize the nature and magnitude of potential risks to public health and the environment which may be posed by release of contamination in wastes and leachate at the WRL Site. The discussion of risk contained in this Alternatives Array Document Baseline Risk Assessment (BRA) to be incorporated in the Remedial Investigation report. Consequently, the assessment presented herein is intended to be qualitative. The BRA will comprehensively quantify risks and support the detailed analysis of alternatives in the Feasibility Study.

Assessment of risks involves identification of contaminants of most concern, pathways of contaminant migration and populations potentially exposed to the contaminants. This information is integrated to estimate contaminant exposure to individuals, and compared to chemical toxicity information to arrive at an estimated total health risk. For a contaminant to pose a potential risk to human health, the contaminant must be hazardous for reasons of either its inherent toxicity, high concentration, high migration potential, exposure potential or resistance to degradation in the environment.

Direct analysis of leachate, groundwater, surface water and sediments were performed as part of the Remedial Investigation at the WRL Site. Discussion of these results are presented in detail in Warzyn's Interim Groundwater Quality Evaluation report (March, 1990).

There is substantive evidence distinguishing groundwater constituents associated with the WRL Site from the Acme Solvents site. It is apparent that constituents residing in the leachate at the WRL Site has released to groundwater at two locations (see Interim Groundwater Quality Evaluation report). The releases are readily identified and traced by elevated chloride concentrations.

The primary potential exposure pathway for risk assessment is from the groundwater when applying hypothetical future use assumptions. Future development at the landfill is highly unlikely and may be limited by regulations. Currently, there is no exposure associated with the groundwater plume. In the future, based on preliminary calculations, some risk may be associated with inorganics, primarily arsenic and thallium under future use (worst case) assumptions. In addition, there is likely minimal risk associated with benzene and 1,2-dichloropropane under worst case, future use assumptions. The above risks have been quantified in the BRA.

Other potential routes of exposure related to the WRL Site include the air pathway (inhalation), direct contact with soils/waste (dermal absorption, incidental ingestion) and exposure from contact with surface water and sediments at Killbuck Creek. The air pathway is not considered for risk assessment because of the remedial measures already in place (i.e., gas migration control). Direct exposure to contaminated wastes/soils is minimized under current conditions by site access restrictions and a cap covering the waste. Killbuck Creek (surface water and sediments) does not appear to have been affected by the WRL Site.

SECTION 4.0
TECHNOLOGY SCREENING

The primary objective of the technology screening process is to identify a manageable number of remedial technologies which can then be assembled into remedial action alternatives. For the WRL Site, this process consists of four steps:

- Develop remedial action objectives;
- Develop general response actions;
- Identify and screen remedial technologies; and
- Summarize the technologies array.

The following subsections implement each of these steps.

4.1 Remedial Action Objectives

In this step, the remedial action objectives, which are the goals for protecting human health and the environment, are developed. Considering the general long-term goals of protecting public health and the environment, and the site-specific goals of reducing the release of contaminants to the groundwater, a number of specific remedial action objectives were developed. These objectives are as follows:

- minimize the potential risks associated with current groundwater contamination by inorganic compounds and by volatile organic compounds (VOCs) potentially attributable to the WRL (dichloropropane, 1,2- and 1,4-dichlorobenzene, chlorobenzene, benzene, xylenes, toluene);

- minimize the potential future contamination of groundwater from landfill leachate, due to the infiltration of rainwater through the landfill waste and base liner to the water table; and

- minimize the risks associated with the potential on-site accumulation or off-site migration of landfill gas.

As part of the RI Report, a baseline risk assessment (BRA) has been performed. As a component of this effort, preliminary ARARs are presented (see Table 1) to provide a more focused statement of the remedial action objective. The final remedial action objectives for the WRL Site FS Report will be based on the ARARs identified in the RI.

4.2 General Response Actions

In this step, the general response actions that will satisfy the remedial action objectives are developed. To satisfy the remedial action objectives, general response actions have been developed for probable sources of health risks.

General response actions and associated technology groups identified for consideration are:

Response Actions	Technology Group
No Action	None
Groundwater Use Restrictions	Deed Restrictions Well Closure
Groundwater Monitoring	
Groundwater Controls	Barriers Gradient Control Extraction/Collection
In-Situ Groundwater Treatment	Physical Chemical Biological
Direct Groundwater Treatment On-Site	Physical Chemical Biological Thermal
Off-Site Groundwater Treatment	Biological Chemical-Physical-Thermal
Treated Water Discharge	Surface Outfall Recharge Wells
Landfill Monitoring	
Landfill Access Restrictions	Fencing Deed Restrictions
Landfill Waste Treatment	Physical Chemical Biological Thermal
Landfill Containment	Cover Cap Vertical Barriers
Landfill Waste Removal and Disposal	Off-site Disposal On-site Disposal

Landfill Leachate Removal and Disposal	On-site Treatment Off-site Treatment
Landfill Gas Control and Treatment	Perimeter Gas Control Interior Gas Collection/Recovery Landfill Gas Treatment

4.3 Identification of Remedial Technologies

In this step, the universe of potentially applicable technologies and process options are identified and then subsequently reduced by screening (evaluating) the options. Technologies and process options were identified based on the types and distribution of contaminants and WRL background information identified during the RI. The identified technologies and process options are presented in Figure 7.

The purpose of the screening process is to select a limited number of promising technologies for consideration in assembling remedial action alternatives. A decision is made whether to retain an identified technology or process option for use in developing alternatives or to eliminate it from further consideration. Criteria used for screening of the options include effectiveness, implementability, and cost.

Effectiveness is the primary criterion used to screen options at this point. Effectiveness is evaluated considering end results; i.e., the ability of the technology to prevent or minimize danger to public health and the environment and thus to meet the remedial action objectives.

Implementability is evaluated considering the technical and institutional feasibility of implementing the technology. Technical implementability considers a range of factors relevant to obtaining, installing, and operating a particular technology. Some remedial technologies are proven and readily available, while others are in the research and development stages. Insufficiently developed technologies are generally screened out. Site conditions must be compatible with the feasible range of a given technology's capability, considering for example, depth to bedrock, depth to groundwater, space and distance requirements, etc. Institutional implementability considers a range of factors relevant to the testing, review, public approval, or agency permitting of a particular technology.

Cost plays a limited role in the screening of options at this point. Technologies are only screened out based on costs which are of a sufficient magnitude to make implementation impractical or impossible, or where other equally effective technologies are available at a significantly lower cost. Where applicable, cost is evaluated relative to both capital and operation and maintenance costs.

4.4 Technology Screening

Potentially applicable remedial action technologies that have been identified for the WRL Site are listed in Figure 7. The Figure briefly describes the technologies, indicates the applicability of each technology, and presents the remedial technologies retained for further consideration. The range of technologies considered is consistent with the remedial action objectives developed earlier in this section.

The screening of potentially applicable technologies considered for the WRL Site is summarized below.

4.4.1 Groundwater Controls

Groundwater control methods fall into three categories: physical barriers, hydraulic gradient control and groundwater extraction or collection. Physical barriers can be effective in controlling the movement of groundwater and its associated contaminants by placement of low permeability barriers to reduce flow from one area to another. Hydraulic gradient control is used to modify local groundwater flow patterns. This is accomplished using water injection, groundwater interception, or a combination of the two. Groundwater extraction/collection, while also a form of gradient control, is additionally used to remove contaminated groundwater for further remediation.

4.4.1.1 Barriers. Both horizontal and vertical barriers are under consideration for the Site. Low permeability vertical cut-off walls or diversions are installed below ground to contain, capture, or redirect groundwater flow in the vicinity of the Site. Slurry walls are the most common vertical subsurface barriers because they are a relatively inexpensive means of vastly reducing groundwater flow in unconsolidated earth materials. An engineered soil mixture is blended with a bentonite slurry and placed in a vertical trench to form a soil-bentonite slurry wall. In some cases, the trench is excavated under a slurry of portland cement, bentonite, and water, and this mixture is left in the trench to harden into a cement-bentonite slurry wall. Slurry walls may be "keyed-in" to a lower layer of confining aquitard material to provide full containment of the contaminant plume, or be of the hanging variety which extend into the water table below the contaminant plume to restrict plume migration. The fractured bedrock beneath the WRL Site does not provide an adequate confining layer aquitard to contain contaminated groundwater and a keyed-in slurry wall will therefore not be retained for alternatives development. Hanging slurry walls are utilized to retard the flow of contaminants floating on top of the water table. As groundwater at the WRL Site contains dissolved contaminants, a floating slurry wall will not be retained for further consideration.

Grout curtains are vertical subsurface barriers created in unconsolidated materials by pressure injection. Grout barriers can be many times more costly than slurry walls and are generally incapable of attaining truly low permeabilities in unconsolidated materials. The vibrating beam method also places grout so as to generate a subsurface wall. As it is difficult to ensure the integrity of a grout curtain or a vibrating beam wall, these technologies will not be retained for alternatives development.

In addition to slurry wall and grouted cut-offs, sheet piling can be used to form a vertical groundwater barrier. Sheet piles can be made of wood, pre-cast concrete, or steel. Wood is an ineffective water barrier, however, and concrete is used primarily where great strength is required. Steel is often the most effective form of sheet piling. Interlocks between barrier material however may be difficult to seal. This technology is not retained because of high associated costs and unpredictable wall integrity.

Bottom sealing refers to techniques used to place a horizontal barrier beneath an existing site to act as a floor and prevent downward migration of contaminants. Both block displacement and grout injection bottom sealing process options involve variations of the grouting techniques as described above. These technologies are not retained for alternative development due to the impracticality of implementing such barriers beneath an existing waste filled landfill.

4.4.1.2 Hydraulic Gradient Control. Injection of water is used to develop a hydraulic barrier or redirect local groundwater flow patterns by creating a mound in the water table. Water can be injected into the aquifer using wells, trenches, or seepage basins. Use of water injection wells, trenches or seepage basins to create a hydraulic barrier is generally implemented as a short term technique to prevent immediate plume migration to a domestic water supply well. As no water supply wells have been identified as being at immediate risk from groundwater contamination attributable to WRL, this technology is not retained for this purpose.

Injection systems can be used in conjunction with extraction wells. The injection of water creates a hydraulic mound which works to redirect contaminated groundwater to the extraction wells. This type of system is applicable to aquifers which have relatively flat hydraulic gradients and moderate hydraulic conductivities. This type of hydrogeology is present at the western end of the WRL, where extraction wells may be placed to remove contaminated groundwater. Enhancement of groundwater extraction via gradient control injection will therefore be retained for alternatives development.

4.4.1.3 Groundwater Extraction/Collection. Groundwater extraction or collection are the most promising methods of controlling groundwater movement, while removing contaminants. Wells and trenches with perforated piping drains are most commonly used to extract and collect groundwater. Trenched piping is more effective for low permeability soils with shallow aquifer contamination (less than 25 feet deep). In this application, an array of extracting wells would be favored over trenches for the extraction of relatively deep contaminants from the sand and gravel aquifer, which has shown indications of variable permeability. The generally high permeability of the Site soils suggests that an array of deep wells placed so that their zones of influence overlap would provide an effective extraction system. This system will be retained for alternatives development, because it is the most generally effective and readily implemented groundwater extraction device for this type of site.

Due to the depth of contaminants equal to or greater than 50 feet below the ground surface, deep well turbine pumps or an ejector well system would be applicable at the WRL Site.

4.4.2 Direct Groundwater Treatment On-Site

Groundwater treatment methods can be divided into four categories: physical, chemical, biological and thermal. Some level of treatment will be required prior to any groundwater discharge, in order to attain effluent limitations. Adequate electrical and water utilities are available at the Site to readily implement an on-site treatment system.

4.4.2.1 Physical Methods. Conventional physical treatment methods such as screening, filtration, or settling would not treat suspected inorganic compounds or VOCs and are therefore not considered viable as primary treatment technologies. A screening/filtration process may be applicable as a pretreatment process and will be retained in this capacity.

Spray Evaporation

Spray evaporation, a process in which contaminated groundwater is sprayed into the air, volatilizing VOCs to the atmosphere, is difficult to control. Complete volatilization of some constituents may be difficult. Once airborne, contaminants may be carried off-site to nearby receptors. Additionally, spraying extracted groundwater over the surface of the landfill would potentially increase the leaching of contaminants from the landfill waste to groundwater. Therefore, spray evaporation is not considered viable for alternatives development.

Air/Steam Stripping

VOCs are conventionally stripped from water using air or steam in a packed column. Water is pumped to the top of a tower packed with a high surface area, high void volume, and inert packing material. Water trickles over the packing and is discharged at the bottom of the tower. The stripping gas is typically introduced at the bottom of the tower. Volatile contaminants are transferred from the water to the stripping gas. For solvents as volatile and readily strippable as the VOCs detected at the Site, at the concentrations anticipated (<1 mg/L), ambient temperature stripping with air is generally used. Air pollution controls may be required. The effectiveness of this technology has been well demonstrated at numerous other sites. Air stripping technology is retained due primarily to its potentially acceptable effectiveness and low cost. Steam stripping would add increased energy costs with minimal increase in effectiveness and is therefore eliminated from further consideration.

Activated Carbon Adsorption

Activated carbon adsorption is also commonly used to remove VOCs from water. Most frequently, granular activated carbon beds are used. Contaminated water flows through the carbon bed and contaminants are adsorbed on the carbon. The process is capable of reducing a wide range of VOCs to acceptable levels for discharge. When the capacity of the carbon is exhausted, the bed is taken out of service. The spent carbon is either regenerated, disposed of in a landfill, or incinerated. The choice of carbon handling methods depends largely on the types and concentration of contaminants and the economics of regeneration versus disposal or destruction. The effectiveness of this technology for removal of the types of VOCs found at the WRL Site has been demonstrated at several other sites, and the technology is thus retained for alternatives development. The process may be considered as a single step treatment technology or as a polishing treatment to reduce VOCs to levels acceptable for discharge.

Ion Exchange

Ion exchange is a process in which an aqueous stream is passed through a bed of charged resins. The resins remove charged ions from the waste stream and in the process release relatively harmless ions which were previously held. This is the exchange process. Ion exchange is applicable for the removal of charged ions or complexes in solution. It is a well proven technology for the removal of heavy metals and anions from dilute solutions. Ion exchange vessels have low space requirements and could be readily implemented at the Site. It is thus retained for potential use in removing inorganic compounds identified in Site groundwater.

Reverse Osmosis

Reverse osmosis (hyperfiltration) is potentially applicable for the removal of inorganics and VOCs. A semi-permeable membrane is used to effect a separation of solvent (water, in this case) and solute (e.g., TCE or chloride, in this case). The pore size in the membrane is such that water passes through more readily than the contaminant. Contaminated water is pumped under high pressure to membrane-holding cartridges. Water with low contaminant levels passes through the membrane (permeate stream) and a concentrated aqueous solution (concentrate stream) remains on the pressurized side of the membrane. A concentrated reject stream must therefore be managed. The relative proportions of permeate and concentrate depend on solute properties, membrane properties, flow rates, operating pressures and the configuration and number of units used in the process. No reports of full scale use of membrane separation for VOC removal have been identified. A major unknown is membrane material compatibility with the contaminants. Laboratory and pilot scale testing to determine feasibility and design parameters would be required. The energy needed to operate a high pressure system and the need for permeate treatment would likely make this a costly and inefficient process. This technology is not considered to be adequately demonstrated at full scale and is therefore not retained.

4.4.2.2 Chemical Methods. Conventional chemical treatment methods such as coagulation, neutralization, or reduction would not be effective in removal of the inorganic compounds or VOCs identified in Site groundwater. These technologies are thus not retained for use at the WRL Site.

Photolysis/Oxidation

Chemical oxidation may be effective in contaminant destruction. Oxidation using ozone and/or hydrogen peroxide is a promising chemical treatment technology. In this process, ozone and hydrogen peroxide are contacted with contaminated water in a reactor. Ozone is fed to the reactor using fine bubble diffusers and hydrogen peroxide is fed as a concentrated liquid solution. Ozone decomposes in water to form hydroxyl radicals, which react with chlorinated ethenes. The addition of hydrogen peroxide accelerates the process, because a hydrogen peroxide decomposition product (hydroperoxide ion) accelerates the decomposition of ozone (Glaze and Kang, 1988). Chemical doses and overall reaction rates must be determined experimentally for a particular water, because of competing oxidation and free radical reactions. The oxidation process can be pretreated by photolysis, the photodegradation of contaminants using ultraviolet radiation or polar solvents, to further remove VOCs. Depending on the volume requirements imposed by the rate of extracting groundwater, space limitations at the site will need to be considered in the FS. Both the oxidation and photolysis technologies are retained for potential use due to their demonstrated effectiveness in contaminant destruction.

Precipitation

Precipitation is a physical-chemical process whereby a contaminant in solution is transformed into a solid phase. This is accomplished by altering the chemical equilibrium of the waste stream such that the solubility of the contaminant is reduced. Lime and sodium sulfide are commonly used as precipitating agents for metals, which are transformed to their insoluble hydroxide or sulfide form. Adjustment of the waste stream pH may also be required to achieve removal goals. A settling chamber or other solids removal process is required to remove the precipitated portion from the remaining liquid phase. Space requirements for this process application at the WRL Site will need to be reviewed during the FS. Precipitation is commonly used to remove heavy metals and various other inorganic compounds from water. It may thus be applicable for treatment of groundwater at the Site and will be retained for alternatives development.

4.4.2.3 Biological Methods. Aerobic biological degradation is potentially applicable to treatment of 1- and 2-carbon chlorinated hydrocarbons which make up the majority of the halogenated compounds present at this Site. Aerobic degradation of these compounds by methanotrophic bacteria has been recently demonstrated. However, reaction rates and microbial growth kinetics have not been well defined for aerobic degradation processes. Additionally, the conventional activated sludge process has been found to be less effective on halogenated hydrocarbons than on other compounds typically found at hazardous waste sites. New reactor configurations are being developed and assessed which show promise, including a fixed-film gas-permeable membrane system (Woods, Williamson and Strand, 1989), a concurrent flow, packed bed, gas-phase continuous reactor (Huffman et al., 1989), and a center downflow, annular space upflow column (Pritchard, 1989). Extensive laboratory and pilot scale studies would have to be conducted to determine removal rates, biological growth kinetics and nutrient requirements. Considering the potential benefit of contaminant destruction, aerobic degradation is retained for alternatives development based on potential effectiveness.

Anaerobic treatment can also be used to reduce contaminants in Site groundwater. The mechanism for anaerobic transformation of the compounds of concern is not well understood. Studies where transformation and degradation has been demonstrated all were conducted under conditions where another carbon and energy source was available (e.g., ethanol, acetate or naturally-occurring sediment organic matter). Therefore, a carbon/energy source and nutrients would have to be provided. Due to the high energy and cost requirements, and the availability of other equally effective technologies, this process is not retained.

4.4.2.4 Thermal Destruction. For aqueous organic waste streams, wet process incineration technologies and wet air oxidation are potentially applicable for treatment of VOCs. Thermal reactors are commercially available (fluidized bed, liquid injection) to treat aqueous organic wastes. However, their applicability does not extend to dilute groundwater streams, and are thus not retained for further use.

Wet air oxidation is a process which utilizes elevated pressures and temperatures in a reactor vessel to oxidize the aqueous organics present. The waste stream is pumped at high pressure and mixed with air. The mixture passes through a heat exchanger and into the reactor where the air reacts with the organics present. This process is generally applicable to a variety of organics, but due to high energy requirements becomes a more cost-effective solution for concentrated, complex organic loads and oxidizable inorganics which are not amendable to other types of treatment. As other equally effective technologies exist (notably conventional oxidation) with significantly less energy requirements, wet air oxidation is not retained for alternatives development.

4.4.3 Treated Groundwater Discharge

Treated effluent from the processes described in the preceding sections may be discharged via recharge wells to the upper aquifer, to local surface waters via conventional pipeline and outfall, or to a publicly-owned treatment works (POTW). Both recharge wells and outfalls to Killbuck Creek are appropriate discharge options for consideration with on-site groundwater treatment systems, and will be retained for alternatives development.

Discharge to the POTW would result in an increase in hydraulic loading on the local plant. Volatilization would be the major fate of VOCs at the POTW, and substantial removal efficiencies may be obtained, even though the plant was not specifically designed for VOC removal. If groundwater were pretreated on-site, this would likely meet best developed available technology (BDAT) requirements for direct discharge, so a POTW discharge would not be necessary. Additionally, POTW performance may be adversely affected due to the increased hydraulic loading with a very low organic content. As other discharge options are available, this discharge option is eliminated from consideration.

4.4.4 In-Situ Groundwater Treatment Methods

In-place treatment of contaminated groundwater can be considered for the physical conditions and contaminants identified at the WRL Site. As with aboveground processes, the technologies can be categorized as physical, chemical or biological methods.

4.4.4.1 Physical In-Situ Methods. Permeable treatment beds are essentially excavated trenches placed perpendicular to groundwater flow and filled with an appropriate material to treat the contaminant plume as it flows through the material. Some of the materials that may be used in the treatment bed are limestone, crushed shells, activated carbon, glauconitic green sands, and synthetic ion exchange resins. Permeable treatment beds have the potential to reduce the quantities of contaminants present in leachate plumes. The system is applicable to relatively shallow groundwater tables containing a plume.

Potentially numerous problems exist in implementing and using a permeable treatment bed. Construction of a trench of adequate depth would be extremely difficult, if not impossible. Operational problems include saturation of bed material, plugging of the bed with precipitates, and short life of treatment materials. This technology would ultimately only slow, not prevent, migration of contaminants. This technology is eliminated from further consideration because of effectiveness and implementability limitations.

4.4.4.2 Chemical In-Situ Methods. The most promising in-situ chemical groundwater treatment method for the contaminants at the WRL Site is oxidation. As discussed previously for direct treatment technologies, ozone and hydrogen peroxide can be used to chemically destroy VOCs in water in a reaction vessel. In principle, these chemicals could be injected into the aquifer to effect volatile destruction. Because the desired reactions would take place in the porous medium of the aquifer instead of in a tank, many other competing reactions could be anticipated. The system would involve feeding chemicals in aqueous solution into water from groundwater extraction wells, and reinjecting the water into the aquifer. Materials of construction (pumps, piping, wells, etc.) must be resistant to the oxidants used.

No reports of chemical oxidation of the contaminants of concern in an aquifer or in soils have been identified, so this technology would require extensive testing. Obtaining approvals for injection of chemicals into the aquifer would likely be time-consuming. This technology is not considered adequately developed for use at the Site, and is therefore eliminated from consideration due to effectiveness and implementability concerns.

4.4.4.3 Biological In-Situ Methods. According to available information, the biological degradation of most low molecular weight chlorinated hydrocarbons occurs mainly under anaerobic conditions. Physically, an in-situ bioreclamation system would be similar to the extraction and injection system discussed above for in-situ chemical treatment. Nutrients, an organic substrate, and possibly a reducing agent would be fed into the reinjection stream instead of chemical oxidants. The goal of this system would be to maintain suitable environmental conditions throughout the aquifer section of interest to support the growth of desired microorganisms to enhance aerobic or anaerobic degradation of contaminants. The major difficulty associated with this treatment is that in some cases, neither the mechanisms responsible for specific compound degradation nor optimum growth conditions have been identified. Therefore, the ability to maintain suitable conditions for effective treatment is difficult to assess at this stage. Obtaining approval for a system incorporating injection of microorganisms and chemicals into an aquifer may be difficult. Due to the potential difficulties associated with implementing and controlling this technology in-situ, it will not be retained for the development of alternatives.

4.4.5 Off-Site Groundwater Treatment

Groundwater could be extracted and conveyed off-site for treatment at a commercial treatment facility licensed to dispose of hazardous waste, or at the local POTW.

Conveyance of untreated groundwater to a commercial disposal facility would likely require trucking of the collected groundwater. Given the expected volume of groundwater to be generated by extraction pumping at the Site (>50 gpm) this option presents unrealistic costs prohibiting its implementation.

phThe use of pressure force main and/or gravity flow buried piping would be the likely candidate to transfer untreated groundwater to the local POTW. The WRL is currently transporting all of the collected landfill leachate for treatment at the POTW, so some of the administrative components for implementing this option are already in place. The WRL is currently developing plans for installation of a gravity flow pipeline to transport landfill leachate to the POTW. Adequate sizing of this pipeline to additionally carry extracted groundwater can be considered. The hydraulic capacity of the existing public sewer lines, pumping system and the POTW, the type of treatment in place and acceptance by the local POTW authority would need to be assessed prior to implementation. This option presents a viable alternative at this time and will be retained for further use.

4.4.6 Institutional Measures

Restrictions on groundwater use may be taken as part of an overall site remedy and would be appropriate for properties within potentially contaminated areas. The feasibility of this depends on the extent of this authority at the state, county, or local levels, and the willingness of the responsible agencies to adopt such restrictions. This institutional measure will be retained for alternatives development.

Deed restrictions for property development on and adjacent to the landfill and continuation of the chain link fence around the entire landfill site would be appropriate measures to provide site access restrictions. These measures are retained for alternatives development.

Monitoring of groundwater will be necessary to assess remediation effectiveness and maintain an understanding of future contaminant distributions. It is therefore retained for use in alternatives development.

4.4.7 Landfill Containment

Several methods of containment of landfill waste and leachate can be considered for alternatives development, including covering, capping, and barriers. These technologies are discussed in the following sections.

4.4.7.1 Soil Cover. A soil cover provides prevention from direct contact with landfill waste and leachate. It would however, provide minimal reduction of surface water infiltration, identified as a remedial objective for WRL. Additionally, a cover would not meet state closure requirements for a landfill and would thus be difficult to implement. Based on insufficient effectiveness and implementability considerations, use of a soil cover will not be retained for the development of alternatives.

4.4.7.2 Capping. Capping is a process used to cover buried waste materials to prevent their release to either the air or groundwater. The designs of caps usually conform to performance standards applicable to the type of waste they contain. For hazardous waste landfills, 40 CFR 264.310 (RCRA Subtitle C) addresses the required landfill closure requirements. For municipal and other non-hazardous special waste landfills, 40 CFR 257 and 258 (proposed) and applicable state standards address the closure requirements. These standards both include minimum liquid migration through the wastes, cover maintenance requirements, sufficient site drainage, high resistance to damage by settling or subsidence, and a permeability lower than or equal to the underlying liner system or natural soils.

There are a variety of cap designs and capping materials available. Most cap designs are multi-layered to conform with the above-mentioned design standards; however, single-layered designs are also used for special purposes.

The design of multi-layered caps for hazardous wastes generally conforms to EPA's guidance under RCRA Subtitle C, which recommends a three-layered system consisting of an upper vegetative layer, underlain by a drainage layer over a low permeability layer. The vegetative layer consists of topsoil; the drainage layer is composed of sand; and the low permeability layer is formed by a combined synthetic and clay liner system.

The design of caps for the final cover of landfills which contain non-hazardous municipal, industrial and other wastes would be governed by RCRA Subtitle D and applicable state standards. Recently proposed rules by U.S. EPA (Federal Register, August 30, 1988) would create a Part 258 to 40 CFR to regulate municipal waste landfills, with Part 257 remaining in place to govern industrial and other types of waste landfills. The proposed rules do not however, specify final cover design or material requirements, and authorize the states to promulgate final cover standards. Current rules by the State of Illinois for final capping include requirements for 2 feet of low permeability compacted clay soil overlaid by a layer of protective soil capable of supporting vegetation. The WRL has an outstanding permit application for closure and post-closure care for the landfill under review by the Illinois Environmental Protection Agency (IEPA), which meets the current state requirements.

For both types of design, the cap functions by diverting infiltration liquids away from the underlying waste materials. The cap design and selection of capping materials is influenced by specific factors such as local availability and costs of cover materials, desired functions of cover materials, the nature of the wastes being covered, local climate and hydrogeology, and projected future use of the site.

The main disadvantages of capping are the need for long-term maintenance and uncertain design life. Caps will need to be periodically inspected for settlement, ponding of liquids, erosion, and naturally occurring invasion by deep-rooted vegetation. In addition, the groundwater monitoring wells, often associated with caps, need to be periodically sampled and maintained. However, these long-term maintenance requirements usually are considerably more economical than excavation and removal of the wastes.

The design life of a cap is uncertain because of the uncertain life of synthetic liner materials (if one is used in the cap), the uncertain amounts of annual rainfall which will infiltrate the cap, and the uncertain rate of waste migration which would result from any infiltrating rainwater. This uncertainty may necessitate the strategic placement of monitoring wells at a site to detect any waste migration, thus signaling the need to replace the cap.

Considering the effectiveness in minimizing infiltration into the landfill and the administrative requirements for implementation noted above, a multi-layer soil-clay cap or a multi-layer synthetic-clay cap would be appropriate for the Site. They will both be retained at this time for alternatives development.

4.4.7.3 Barriers. Vertical barriers considered for landfill leachate containment include slurry walls, grout curtains, sheet piles and vibrating beam walls. These structures were also considered previously in this section relative to groundwater control, and were found to be inappropriate for use at WRL due to effectiveness and implementability limitations. Vertical barriers present these same limitations for application to landfill leachate containment and are thus not retained for alternatives development.

4.4.8 Landfill Waste Treatment

Direct on-site treatment of landfill waste can be considered (Figure 7). Due to the large volume of waste currently at the Site and the fact that municipal landfills typically contain significant portions of relatively hard to treat wastes (plastics, metal debris, synthetic materials, etc.), limited treatment technologies would be applicable.

Biological and chemical treatment technologies are relatively specific processes to treat a limited type or group of compounds. The landfill waste at WRL likely includes a variety of chemical constituents which would interfere with the treatment of the contaminants of concern, thus raising questions as to the process's effectiveness. These types of technologies additionally require substantial intermixing of the treatment agents or nutrients with the waste. This would be very difficult to implement for a large volume of compacted waste in place. The process options within the biological and chemical treatment technology groups are therefore eliminated from further consideration.

Physical treatment technologies such as solvents, volatilization and soil washing present the same limitations as noted above for biological and chemical treatment, and are not retained for further use.

A fixation process, whereby waste is transformed into a stable, solidified mass may be applicable for landfill waste treatment. Cement and silica based setting agents are commonly available, which may be mixed with proprietary chemicals depending on the specific application. Solidification technologies generally involve excavation of the waste, which is then mixed with the required chemicals in a constructed chamber, tanks or using commercial cement mixing equipment. Fixation may also be performed in a lagoon or excavated pit and left in place (in-situ). Bench scale testing would be required to determine the optimal chemical mix and to perform leachate testing of the solidified mass. Implementing this technology may be difficult due to the need to excavate waste from a large landfill area. However, of the technologies reviewed under this subsection, fixation presents the most viable waste treatment option available for consideration and will be retained for alternatives development.

4.4.9 Landfill Waste Removal and Disposal

The waste currently in place at WRL could theoretically be excavated and removed to a separately constructed landfill either at an on-site or off-site location. Implementing this option would be costly due to the waste volume and very difficult to administratively implement, as a newly constructed landfill would be required. It is thus not retained for use in alternatives development.

4.4.10 Landfill Leachate Removal and Disposal

A potential continuing source of groundwater contamination by WRL is the leachate which collects at the bottom of the landfill due to surface water infiltrating through the waste. To minimize the effects of leachate leaking through the landfill's base liner to the water table, the leachate liquid can be removed and appropriately treated and disposed. Both on-site and off-site disposal options are considered.

Off-site disposal options include trucking pumped leachate to a commercial off-site disposal facility or transporting leachate through a pipeline or via tank trucks to the local POTW. An existing leachate removal system is in place at WRL which includes collection drain piping, manholes and a leachate pumping system. Collected leachate is recycled to the waste or is stored on-site in a holding pond on top of the landfill and periodically trucked to the local off-site POTW. The POTW treats and discharges the leachate along with the wastewater processed at the plant. This type of system can be effective in minimizing the opportunity for leachate to act as a contaminant source to groundwater, if a sufficient rate of leachate extraction is practiced. POTW treatment can successfully destroy the contaminants of concern. The specific components and procedures utilized at WRL and the treatment methods employed at the POTW may necessitate that some alterations to the existing system be implemented. The capacity of the proposed gravity pipeline for future leachate transport to the POTW must be assessed. These items can be evaluated during the more detailed technology screening performed during the FS. Off-site treatment of leachate at the POTW is thus retained for use in alternatives development.

Direct treatment of landfill leachate on-site can be considered, and would likely include combining leachate and extracted groundwater into a common waste stream. As the contaminants of concern are virtually the same for leachate as for groundwater, the technology screening presented previously in this section for direct groundwater treatment would apply here also. This option is retained for further consideration.

4.4.11 Landfill Gas Control and Treatment

To reduce the potential risks associated with the release of landfill gas at WRL, a variety of technologies are available to control, collect and treat the gaseous emissions. As noted in Section 2, an active gas extraction and thermal treatment (gas is burned to operate sewage sludge dryers) system is currently in place.

To control landfill gas migration, perimeter gas control systems (active and passive) can be considered. Passive perimeter systems incorporate the installation of trenches filled with high permeability materials and/or low permeability barriers around the landfill to control gas flow and prevent its migration to receptors. Active perimeter gas control systems consist of gas extraction wells and buried collection headers which are connected to vacuum blowers. The headers and wells are placed at the perimeter of the landfill, and the blowers create a pressure differential which draws gas into the header and well system, thus preventing gas migration off-site. To provide effective gas control, the system employed must be able to intercept the migrating gas from the natural subsurface pathways. For a passive trench, a maximum depth of 30 feet for open trench excavation presents a constraint for implementation. The lack of a confining clay or bedrock layer in the subsurface around the site presents questions as to the effectiveness of either type of perimeter control system in intercepting all of the potential gas migration pathways. Additionally, an extensive series of interior gas extraction wells are in place, which can intercept the landfill gas at the source. Use of a perimeter gas control system is thus not retained for alternatives development.

Active interior gas collection systems can be utilized to collect the gases beneath the landfill surface and thus prevent their migration to the atmosphere or through subsurface pathways to potential receptors. As with the active perimeter system described above, vacuum blowers create a pressure differential which draws the gas into the connected extraction wells and gas collection piping. With an active interior system, the collection piping and wells are placed throughout the interior of the landfill area. This is a well established, effective means of controlling landfill gas. This technology retains the added advantage in that an active interior system with collection piping, extraction wells and vacuum blowers is currently operating at WRL. During the FS, potential modifications to the existing gas collection system to enhance the system's effectiveness can be analyzed if necessary, to adequately reduce the risks associated with landfill gas and guarantee its long term continued operation. This technology is retained for use in the development of alternatives.

Collected landfill gas can be treated via incineration, flaring or adsorption technologies. Collected gas at WRL is currently incinerated to provide a power source for the landfill's sludge dryers. The operator of the dryer system, NRG, currently has a contract with the local POTW authority to continue accepting sewage sludge for an additional 13 years. Flares are a category of the combustion process whereby waste gases are exposed to an open flame with the combustion byproducts released directly to the atmosphere. Flares and centralized incinerators provide destruction of contaminants,.but removal efficiencies and air pollution requirements must be evaluated on a case by case basis. Supplemental fuel may be required to adequately sustain a flame for the flaring process. Carbon adsorption of the collected gas may be applicable for the removal of organic compounds prior to their release to the atmosphere.

An analysis will be included in the FS to determine the most effective option for adequately treating the landfill gas at WRL on a long term basis. Likely candidates include implementing administration provisions to guarantee the long-term continued use of the sludge dryer system after final closure, and modifying the existing gas collection system to incorporate flaring or adsorption of the gas. At this time, all three of these technologies are retained for alternatives development.

4.5 Process Options Passing Technology Screening

Considering the Site and contaminant characteristics and remedial action objectives, the following process options are retained for consideration in developing alternatives:

Response Action	Remedial Technology	Process Option
No Action	None	None
Groundwater Use Restrictions	Deed Restriction	
Groundwater Monitoring	Monitoring Wells	
Groundwater Controls	Gradient Control	Trenches Wells
	Extraction/Collection	Extraction Wells
Direct Groundwater Treatment On-Site	Biological Treatment	Aerobic
	Chemical Treatment	Oxidation Photolysis Precipitation
	Physical Treatment	Screening/Filtration Air Stripping Carbon Adsorption Ion Exchange
Off-Site Groundwater Treatment	Biological Treatment	Discharge to POTW
Treated Water Discharge	On-Site Discharge	Recharge Wells Surface Water Outfall
Landfill Monitoring	Post-Closure Care	
Access Restrictions	Fence Deed Restrictions	
Landfill Containment	Cap	Multi-Layer (Soil-Clay) Multi-Layer with Membrane
Landfill Direct Waste Treatment	Physical Treatment	Fixation
Landfill Leachate Removal and Disposal	Off-Site Treatment On-Site Treatment	Discharge to POTW Groundwater Options
Landfill Gas Control and Treatment	Interior Gas Collection Gas Treatment	Active System Incineration Flaring Carbon Adsorption

SECTION 5.0
DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The primary objective of this phase of the Feasibility Study is to assemble the remedial technologies carried through in the initial screening process into remedial action alternatives that protect human health and the environment and encompass a range of appropriate waste management options. Alternatives were assembled to address the remedial action objectives relative to the contamination of the air and groundwater. Assembling alternatives by this method addresses the specific Site conditions.

From the general response actions and technologies which passed the initial screening process in Section 4, several assembled alternatives incorporating treatment and containment options were selected for further consideration. This is consistent with the recommendations contained in the U.S. EPA manual "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" Interim Final, October 1988.

Several groundwater and leachate treatment options are considered for use in the following alternatives, including direct treatment on-site and off-site POTW treatment. More than one treatment option may be required in order to meet expected removal efficiencies for discharge. Discharge of treated water may be to Killbuck Creek or to on-site recharge wells or trenches.

Available options relative to landfill waste remedial actions are more limited due to the fact that WRL is a relatively large, almost completely filled landfill site. Alternative remedial actions for the landfill include both containment and treatment of waste.

5.1 Alternative 1 - No Action

The No Action alternative is evaluated as required by the NCP. Under this scenario, no remedial action beyond existing state requirements will be taken at the Site. Existing state requirements include capping the landfill at closure, and post-closure monitoring and care of the landfill. Minimal administrative actions such as additional monitoring may be undertaken with this alternative.

ALTERNATIVES 2 THROUGH 8 - COMMON ELEMENTS

There are several elements common to the remedial alternatives identified below. These elements involve actions that will likely be common to any alternative ultimately selected. Alternative 2 through 9 as presented below will include these common elements unless noted by exception. Common elements are:

Institutional Measures: Institutional measures, most likely in the form of deed restrictions, are anticipated to be implemented to either limit specific future users of the land and/or the groundwater, or to make future uses of such resources. aware of prior conditions and the basis of those actions. The implementation of the institutional measures will depend upon the authority at the various governmental levels to enact and enforce such restrictions.

Access Restrictions: Access by the general public to the site will be restricted through the use of physical structures. It is anticipated that the existing fencing will be adequate to provide such restrictions.

Monitoring and Care: Post-closure monitoring and care of the landfill will be required in accordance with requirements of the State, in compliance with the closure plan, and any additional requirements identified in the record of decision.

Gas Collection and Treatment: As part of the remedial design, the capacity and areal influence of the gas extraction system will be further evaluated to determine the need and, if needed, the placement of gas extraction wells in the currently active portion of the landfill, and the need and feasibility of modifications to the current system to achieve the selected remedy.

Leachate Extraction Enhancement: Preliminary evaluation of the adequacy of the leachate extraction system will be made as part of the feasibility study. The need for modification of the system will be further evaluated during remedial design.

Clay-Soil Landfill Cap: A double layer clay and soil cap will be installed as part of closure in compliance with State regulations for a municipal waste landfill.

5.2 Alternative 2 Clay-Synthetic Membrane Cap

In addition to implementing the common elements noted above, this alternative considers the upgrading of the soil-clay cap to a RCRA Subtitle C compliant waste cap to limit the infiltration of precipitation. Leachate will be collected and transferred to the publicly owned treatment works (POTW) for treatment.

5.3 Alternative 3 Off-site Treatment of Leachate and Groundwater

The common elements noted above would be implemented under this alternative. In addition, both leachate and contaminated groundwater would be extracted and transported to the POTW for treatment.

5.4 Alternative 4 On-site Treatment and Air Stripping of Groundwater

In addition to implementing the common elements noted above, leachate would be extracted and transported to the POTW for treatment. Contaminated groundwater would be extracted, treated on-site, and discharged to Killbuck Creek. Various treatment technologies and enhancements will be analyzed to identify the most appropriate treatment stream for the groundwater. A typical treatment train may include chlorination to remove cyanide, precipitation to remove heavy metals followed by sedimentation and neutralization. If required, additional treatment for inorganics, such as ion exchange, will be considered. The treated groundwater will be routed to an air stripping system for reduction of volatile organic compounds, followed by discharge to Killbuck Creek. The need for activated carbon treatment of the air emissions will be evaluated.

5.5 Alternative 5 On-site Treatment and Air Stripping of Groundwater and Leachate

In this alternative, leachate and groundwater would be combined in a flow equalization tank and treated as in Alternative 4. The common elements noted above would apply.

5.6 Alternative 6 On-site Photolysis/Ozonation of Groundwater

The common elements noted above would be applied. In addition, contaminated groundwater would be treated on-site by precipitation to remove inorganics followed by ultraviolet photolysis and ozonation to remove organics and then discharged to Killbuck Creek. If required, ion exchange would follow the precipitation process to remove inorganics. Leachate would be extracted and transported to the POTW for treatment.

5.7 Alternative 7 On-site VOCs/metals Co-removal Treatment

5.8 Alternative 8 In-Situ Waste Fixation

Under this alternative the landfill would be stabilized in place by fixation, involving the injection and/or mixing of a cement-clay mixture into the closed landfill. The common elements stated above, except placement of a soil-clay cap and gas extraction, would be implemented. Contaminated groundwater would be extracted, treated on-site by precipitation and air stripping and then discharged to Killbuck Creek.

The common elements stated above should be applied under this alternative. Both groundwater and leachate would be extracted and combined in a flow equalization tank. The groundwater-leachate mixture would be treated for both inorganics and organics in a co-removal process developed by Unocal. In this process, heavy metals would be precipitated out while the volatile organic compounds were stripped. Pretreatment for cyanide removal may be required ahead of the co-removal process. The treated effluent would be discharged to Killbuck Creek.

Section 6

POTENTIAL ARARs

Potential applicable or relevant and appropriate requirements (ARARs) for the remedial alternatives presented in Section 5.0 are presented in Table 7. The U.S. EPA Region V and the IEPA will ultimately identify ARARs specific to the WRL.

SECTION 7
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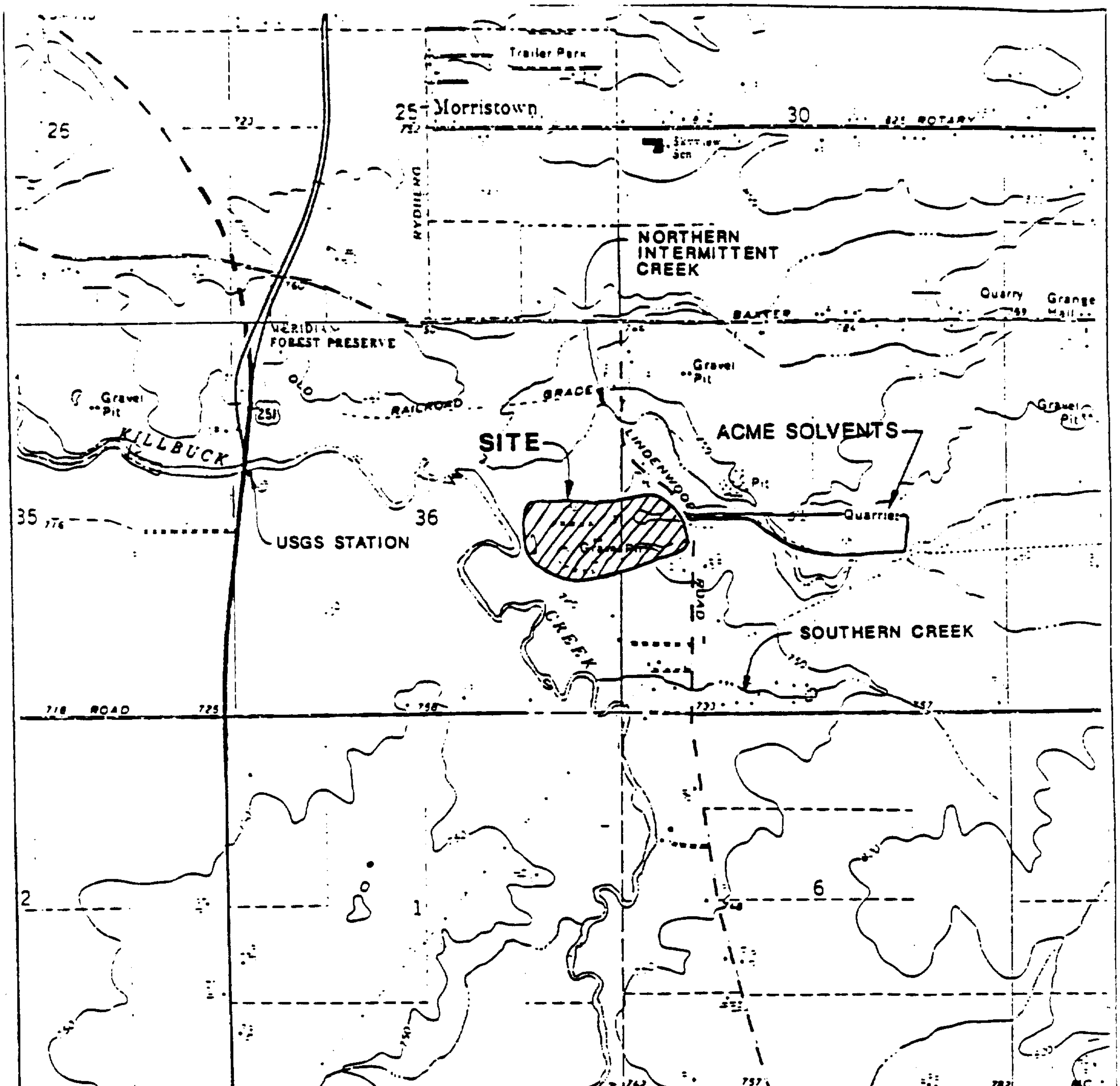


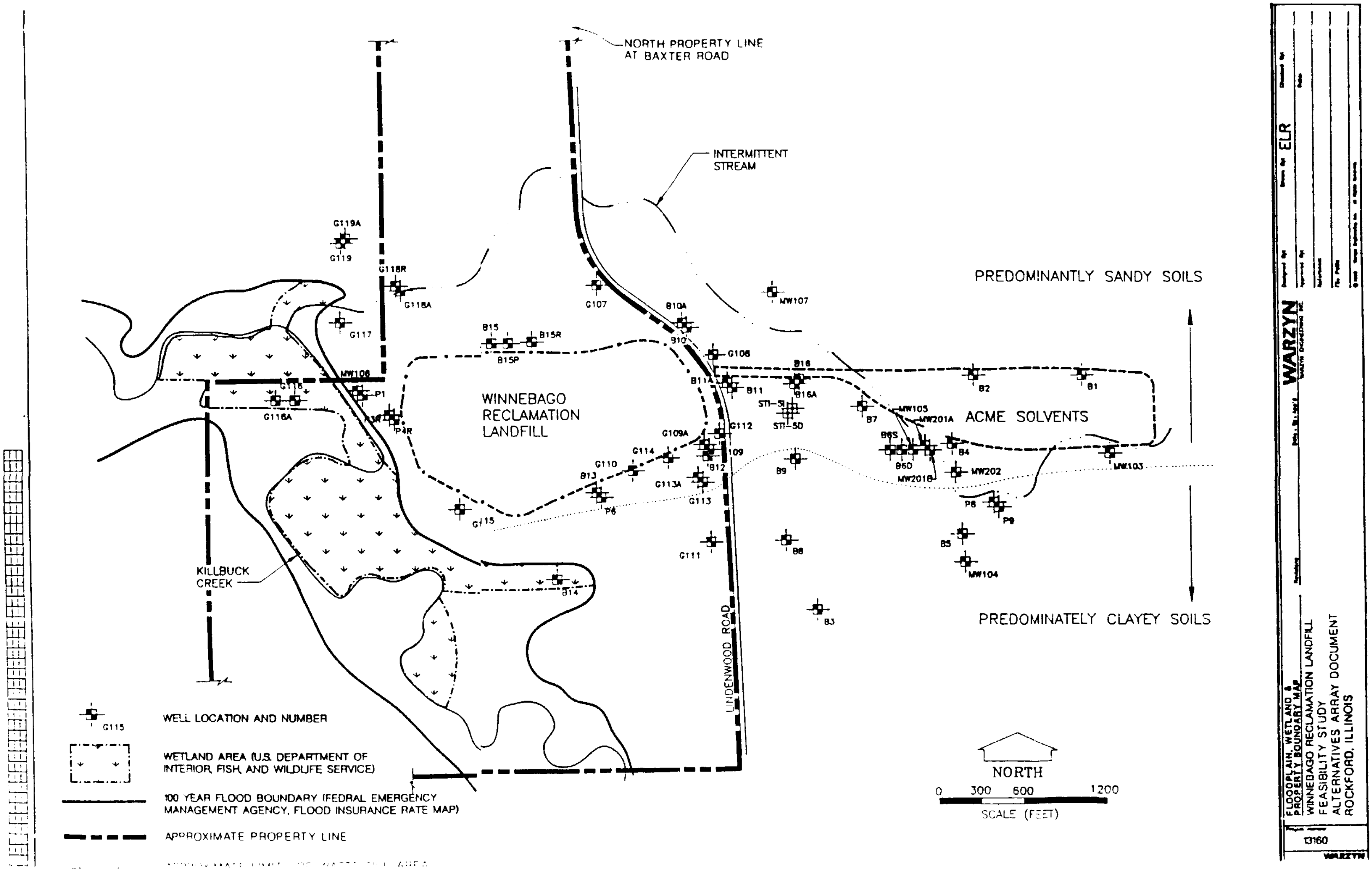
BASE MAP DEVELOPED FROM ROCKFORD SOUTH, ILLINOIS
7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE MAP
DATED 1971 PHOTOREVISED 1976

north

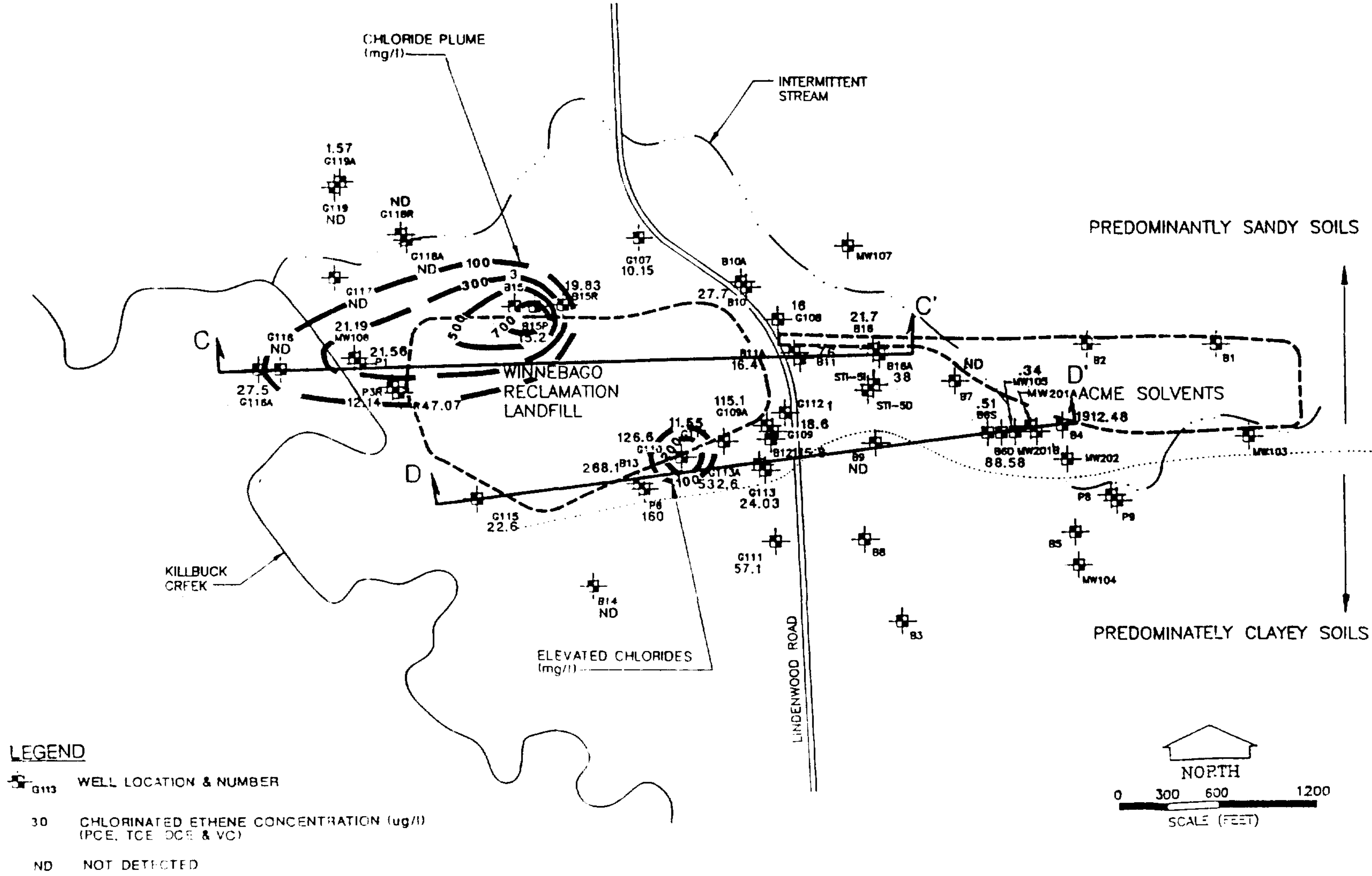
SCALE: 1"=2000'

FIGURE 1

DWN D.L.L.	APP'D [illegible]	DATE 11/22/89	13160	WARZYN ENGINEERING INC	SITE LOCATION MAP WINNEBAGO RECLAMATION LANDFILL FS - ALT. ARRAY DOC. ROCKFORD, ILLINOIS



NORTH PROPERTY LINE AT BAXTER ROAD
INTERMITTENT STREAM
PREDOMINANTLY SANDY SOILS
PREDOMINATELY CLAYEY SOILS
WINNEBAGO RECLAMATION LANDFILL
ACME SOLVENTS
KILLBUCK CREEK
LINDENWOOD ROAD
G119A
G119
G118R
G118A
G117
G116
G116A
MW106
P1
P4R
G107
B10A
B10
MW107
B15
B15R
B15P
G108
B16
B16A
B11A
B11
B2
B1
STI-SI
STI-SD
B7
MW105
MW201A
G112
G109A
B6S
B4
B6D
MW201B
MW202
MW103
G114
G110
B13
B12
B9
G113A
G113
P6
P8
P9
G115
B5
MW104
G111
B8
B14
B3
NORTH
0 300 600 1200
SCALE (FEET)
WELL LOCATION AND NUMBER
WETLAND AREA (U.S. DEPARTMENT OF INTERIOR, FISH, AND WILDLIFE SERVICE)
100 YEAR FLOOD BOUNDARY (FEDRAL EMERGENCY MANAGEMENT AGENCY, FLOOD INSURANCE RATE MAP)
APPROXIMATE PROPERTY LINE
WARZYN
ELR
FLOODPLAIN, WETLAND & PROPERTY BOUNDARY MAP
WINNEBAGO RECLAMATION LANDFILL
FEASIBILITY STUDY
ALTERNATIVES ARRAY DOCUMENT
ROCKFORD, ILLINOIS
13160



ROUND 2 CHLORINATED ETHENES (ug/l)

WINNEBAGO RECLAMATION LANDFILL
FEASIBILITY STUDY
ALTERNATIVES ARRAY DOCUMENT
ROCKFORD, ILLINOIS

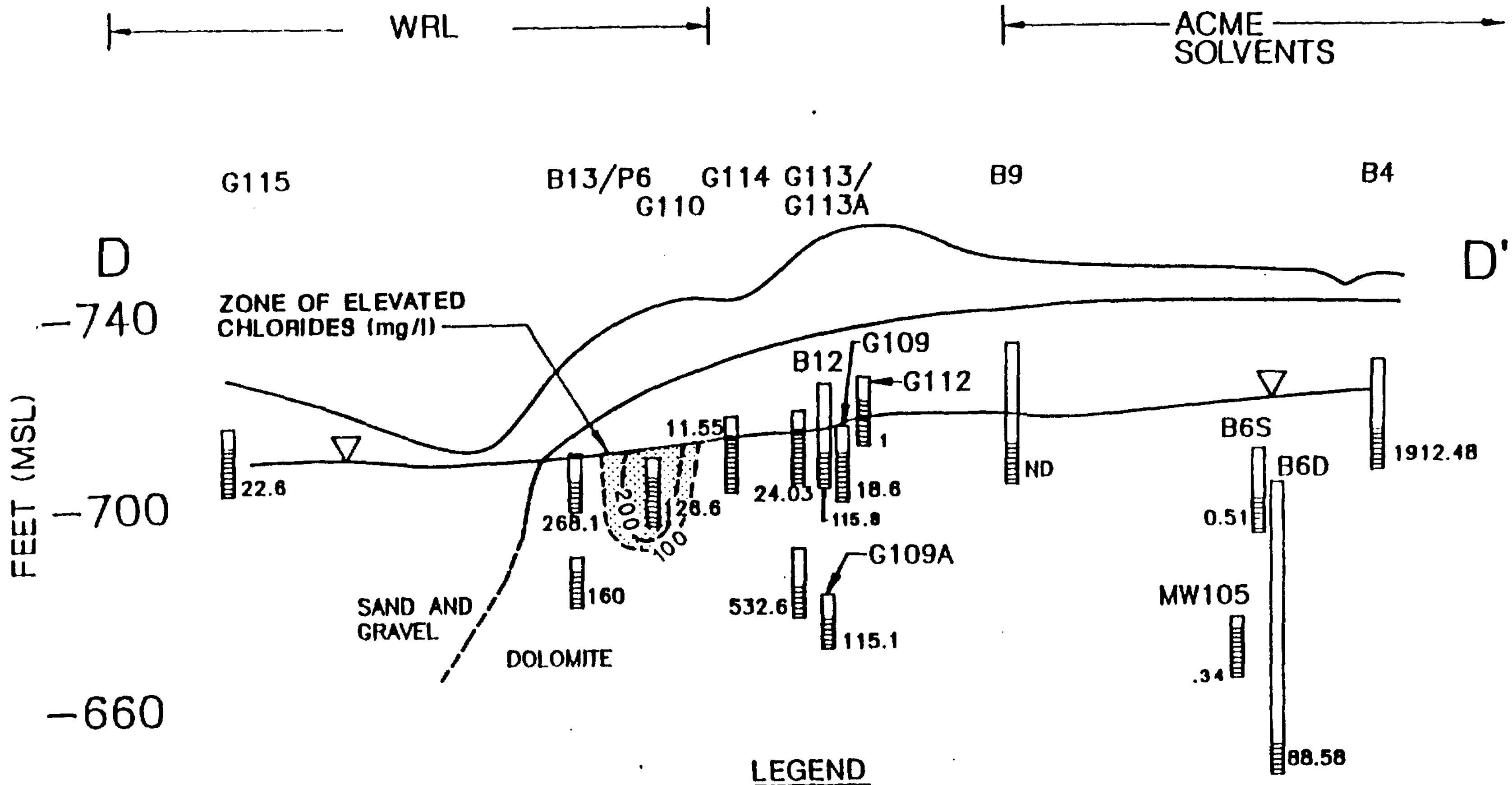
WARZYN

ELR

OF

13160

FIGURE 3



LEGEND

38 LOCATION OF WELL SCREEN AND TOTAL CONCENTRATION OF CHLORINATED ETHENES (ug/l) (PCE, TCE, DCE & VC)

NOTES:

SEE FIGURE 2 FOR CROSS-SECTION LOCATION.

DWN ELR
APP'D
DATE: 1-2-92
13160

WARZYN

FIGURE 4

ROUND 2 TOTAL ETHENES (ug/l)

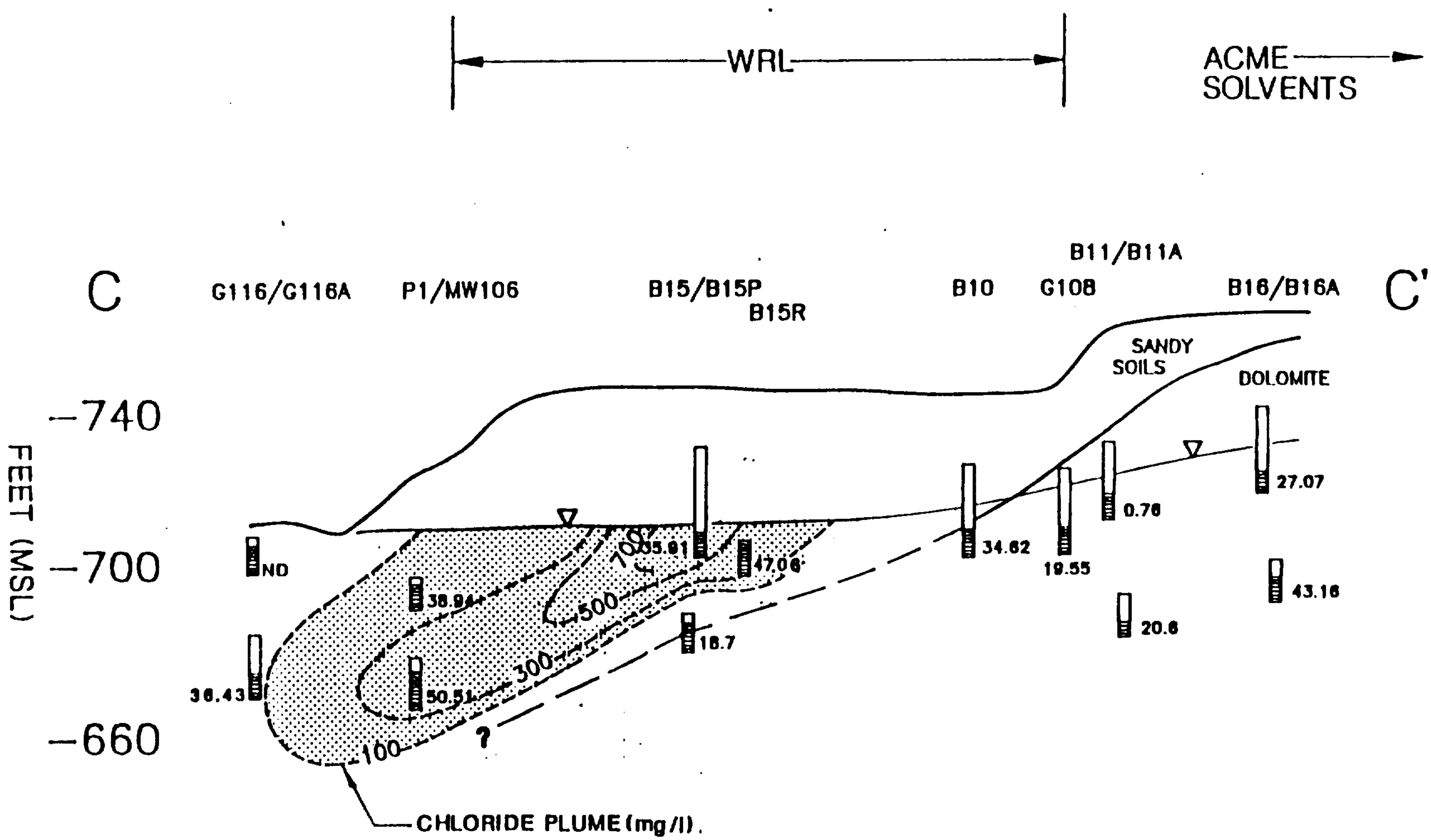
WINNEBAGO RECLAMATION LANDFILL FS - ALT. ARRAY DOC.
ROCKFORD, ILLINOIS

NOTES:

SEE FIGURE 2 FOR CROSS-SECTION LOCATION.

LEGEND

38 LOCATION OF WELL SCREEN AND TOTAL CONCENTRATION OF ALL VOC's (ug/l)



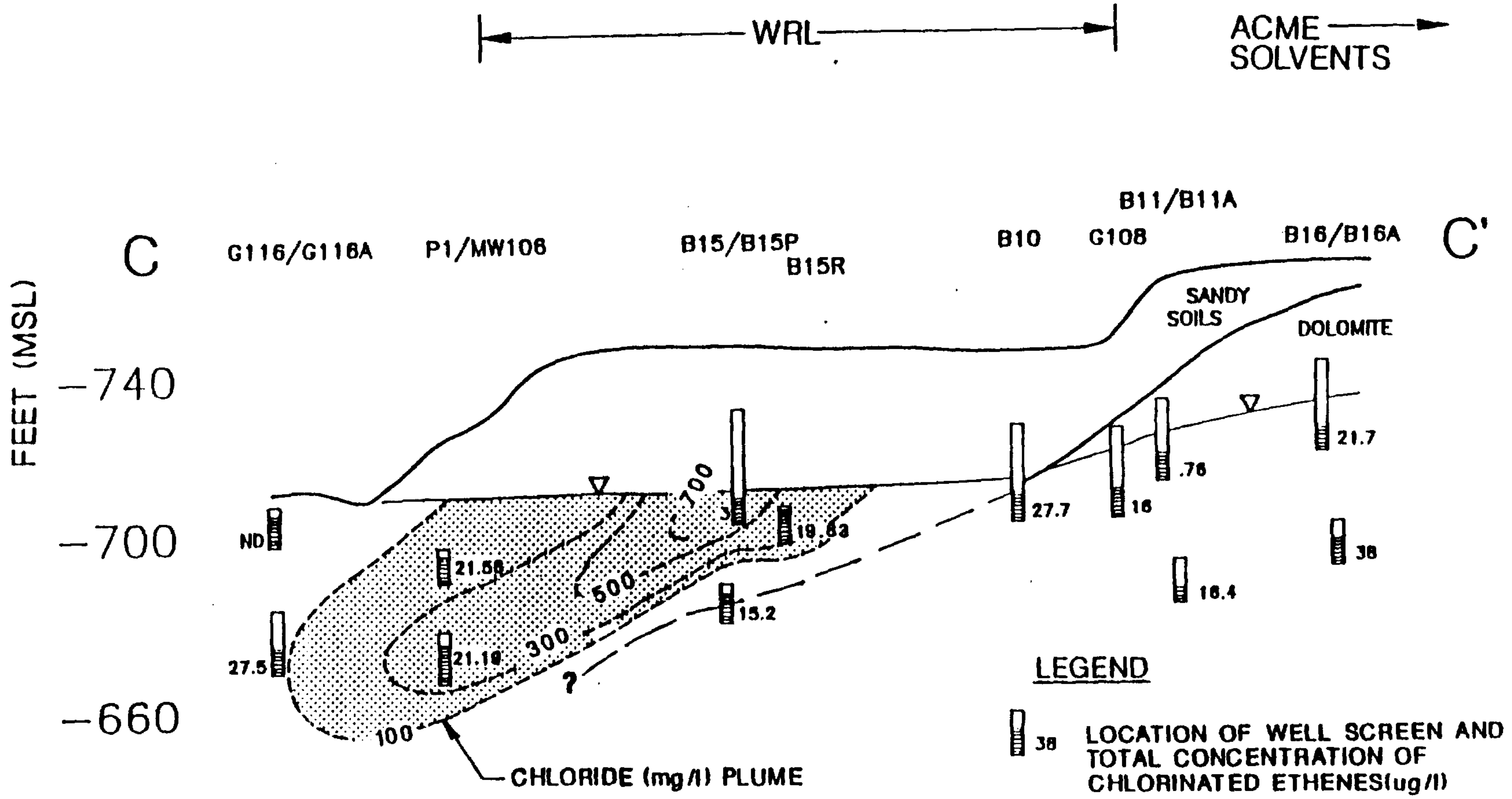
DWN ELR
APPD
DATE 11-22-94
13160

WARZYN

FIGURE 5

ROUND 2 TOTAL VOCs (ug/l)

WINNEBAGO RECLAMATION LANDFILL FS - ALT. ARRAY DOC.
ROCKFORD, ILLINOIS



NOTES:

SEE FIGURE 2 FOR CROSS-SECTION LOCATION.

DWN ELR APP'D DATE 11-22-94 13160

WARZYN ENGINEERING INC

FIGURE 6

ROUND 2 TOTAL ETHENES (ug/l)

WINNEBAGO RECLAMATION LANDFILL FS - ALT. ARRAY DOC. ROCKFORD, ILLINOIS

Remedial Technology Screening (Continued)
Winnebago Reclamation Landfill

MEDIA	RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
Groundwater	Direct Treatment Onsite	Biological Treatment	Aerobic	Use microorganisms in an aerobic environment to degrade organics.	Potentially viable
			Anaerobic	Use microorganisms in an anaerobic environment to degrade organics.	High energy requirements. Other equally effective technologies are available
		Chemical Treatment	Precipitation	Alteration of chemical equilibrium to reduce solubility of the constituent.	Potentially viable for metals contaminants.
			Oxidation	Chemical oxidation of groundwater contaminants using an oxidization agent such as peroxide, hypochlorite, chlorine gas or ozone.	Potentially viable.
			Photolysis	Photodegradation of contaminants using UV radiation.	Potentially viable
			Reduction	Reduction of chlorinated organics and hexavalent chromium.	Not applicable to types of contaminants present.
		Physical Treatment	Screening/ Filtration	Physical removal of suspended solids from a waste stream.	Potentially viable for pretreatment prior to VOC removal.
			Air Stripping	Contacting of large volumes of air with water in a packed column or through diffused aeration to promote transfer of VOC's to air	Potentially viable for organic contaminants
			Steam Stripping	Similar to air stripping except steam is pumped into stripping column to add heat in the promotion of VOC's from liquid to air	Additional costs compared to air stripping not warranted.
			Carbon Adsorption	Passage of contaminated water over columns of activated carbon where contaminants adsorb onto the carbon surfaces.	Potentially viable for organic contaminants
			Reverse Osmosis	Use of high pressure to force clean water through a membrane leaving contaminants behind	Cost is prohibitive. Effectiveness is unproven
			Ion Exchange	Contaminated water is passed through a bed of resin material where exchange of ions occurs between the bed and the water.	Potentially viable for inorganic contaminants
			Spray Evaporation	Contaminated water sprayed into the air where volatile compounds are transferred from the water. Large collection ponds receive spray water	Process difficult to control. Once airborne, contaminants may be carried offsite. Complete volatilization of some constituents may not occur.
		Thermal Destruction	Incineration	Thermal destruction of organic contaminants using any one of many reactor types suited to handle aqueous wastes.	Not practical for treating groundwater with low level contamination
			Wet Air Oxidation	Oxidation of organic contaminants at elevated temperatures and pressures	Energy intensive Other equally effective technologies are available
	Offsite Treatment	Biological Treatment	Discharge to POTW	Contaminated groundwater is pumped and discharged to POTW	Potentially viable.
		Chemical, Physical, Thermal Treatment	Transport to Offsite Treatment Facility	Contaminated groundwater is pumped for above ground storage and trucked to offsite disposal facility	Cost is prohibitive
	Treated Water Discharge	Offsite Discharge	Discharge to POTW	Treated water is pumped to the local POTW	Additional POTW treatment of treated water not required.
		On-site Discharge	Recharge Wells	Treated water is reinjected into the upper aquifer or bedrock aquifer via a series of injection wells	Potentially viable
			Surface Water Outfall	Treated water is discharged to a local stream	Potentially viable

Legend

Not carried forward

Figure 7
(2 of 5)

Remedial Technology Screening (Continued)
Winnebago Reclamation Landfill

MEDIA	RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
Landfill	Direct Waste Treatment	Biological Treatment	Composting	Materials placed in controlled environment with addition of heat and air to aid microbial degradation of organics.	Not effective for heterogeneous landfill waste and debris
		Chemical Treatment	Oxidation	Oxidizer such as ozone, hydrogen peroxide, or permanganate is introduced into a contactor when it mixes with soil and oxidation occurs	Not effective for heterogeneous landfill waste and debris
			Dechlorination Process	Sodium reagent used to strip chlorine atoms from chlorinated hydrocarbons	Not effective for heterogeneous landfill waste and debris
			Wet Air Oxidation	Oxidation of organics in a reactor under high temperature and pressure	Not effective for heterogeneous landfill waste and debris
			Reduction	Reduction of chlorinated organics and hexavalent chromium.	Not effective for heterogeneous landfill waste and debris
		Physical Treatment	Solvent Extraction	Solvent is introduced into contactor where it mixes with solids and extract is collected and later treated.	Not effective for heterogeneous landfill waste and debris
			Retrievable Sorbents	Absorbent materials with ability to concentrate contaminants are mixed with soil. Use of magnetic particles in sorbents allows their collection and removal.	Not effective for heterogeneous landfill waste and debris
			Soil Washing	Use of water or steam to wash or volatilize and flush contaminants from soil or gravel.	Not effective for heterogeneous landfill waste and debris
			Thermal Volatilization	VOC volatilization in a soil drying unit.	Not effective for heterogeneous landfill waste and debris
			Fixation	Solidification or stabilization of wastes using sulfide, lime, cement, molten glass, or various proprietary or patented products.	Potentially viable
		Thermal Destruction	Pyrolysis	Solids are burned in an oxygen deficient atmosphere to produce other residue and volatile organic gases which are then incinerated	Cost is prohibitive for large volume of heterogeneous waste materials
			Rotary Kiln	Solids are fed into a horizontally rotating cylinder designed for uniform heat transfer.	Cost is prohibitive for large volume of heterogeneous waste materials
			HTFW Reactor	Solids are fed into a high temperature fluid wall reactor where heating is supplied by large electrodes in a refractory lined vessel	Cost is prohibitive for large volume of heterogeneous waste materials
			Multiple Hearth	Solids are burned in a reactor consisting of a rotating central shaft and a series of hearths.	Cost is prohibitive for large volume of heterogeneous waste materials
			Fluidized Bed	Solids are added to a hot agitated bed of sand where heat transfer and combustion occur.	Cost is prohibitive for large volume of heterogeneous waste materials
			Molten Salt	Solids are fed into a furnace with a molten salt bed acting as a catalyst and dispersing medium for incinerating wastes.	Cost is prohibitive for large volume of heterogeneous waste materials
			Infrared	Combustion of solids in a horizontal rectangular chamber using electric infrared heat.	Cost is prohibitive for large volume of heterogeneous waste materials
			Liquid Injection	Liquid wastes are atomized with high pressure air or steam and burned in suspension	Cost is prohibitive for large volume of heterogeneous waste materials

Legend

Not carried forward

Figure 7
(4 of 5)

Remedial Technology Screening (Continued)
Winnebago Reclamation Landfill

MEDIA	RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
Landfill	Waste Removal & Disposal	Excavate & Dispose	Offsite	Materials excavated and transported to any offsite RCRA landfill for disposal.	Volume too large
			On-site	Materials excavated and transported to an on-site RCRA landfill for disposal.	Volume too large
	Leachate Removal & Disposal	On-Site Treatment		Combine pumped leachate with on-site groundwater treatment stream	Potentially viable
		Off-Site Treatment	Discharge to POTW	Transport leachate to local POTW for treatment.	Potentially viable, currently employed at the facility
			Transport to Offsite Treatment Facility	Pumped leachate is trucked to an offsite disposal facility.	Equally effective alternative is in place
	Gas Control	Perimeter Gas Control	Passive System	Barriers or permeable gas migration trenches installed at the perimeter of a landfill to prevent off-site migration of landfill gas.	Effective interior gas collection system is currently in place. Potential gas migration pathways difficult to intercept.
			Active System	Vacuum extraction wells and piping installed at the perimeter of a landfill to intercept migrating landfill gas	Effective interior gas collection system is currently in place. Potential gas migration pathways difficult to intercept
		Interior Gas Collection/ Recovery	Active System	Vacuum extraction wells and piping installed throughout the interior of the landfill to collect and recover or destroy landfill gases.	Potentially viable. System currently in place can be utilized and modified as required for future use after landfill closure.
		Gas Treatment	Incineration	Collected gas is transferred to a central incineration unit for combustion to destroy the contaminants.	Potentially viable. Current system can be modified for future use if required
			Flaring	Collected gas is exposed to an open flame at multiple collection points	Potentially viable
			Active System	Collected gas is passed over activated carbon to adsorb organics onto carbon media.	Potentially viable

Figure 7
(5 of 5)

TABLE 1
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGES
WRL AREA GROUNDWATER

COMPOUND	MAX. CONC. ug/L	MIN. CONC. ug/L	# OF DETECTS*	AVG. CONC. ug/L	GEOMETRIC MEAN ug/L
GW Indicators					
Alkalinity (mg/L)	1640.000	246.000	81	626.56	547.26
Chloride (mg/L)	860.000	7.000	81	117.63	52.32
Phenol (mg/L)	170.000	5.000	54	15.35	9.84
Sulfate (mg/L)	73.000	5.000	34	34.65	30.84
Nitrate+Nitrite Nitrogen (mg/L)	11.600	0.030	16	4.27	0.86
Metals					
Arsenic	46.000	2.000	27	15.66	11.51
Barium	1145.000	25.300	78	357.44	221.57
Cadmium	16.000	0.200	32	1.62	0.67
Calcium	225000.000	46200.000	14	118578.57	108493.88
Chromium, Total	3.500	0.300	16	1.15	0.79
Cobalt	84.000	63.000	2	73.50	72.75
Copper	122.000	122.000	1	122.00	122.00
Iron	11000.000	109.000	9	2890.56	989.52
Lead	37.000	6.000	4	20.50	14.93
Magnesium	107000.000	25800.000	14	64578.57	60482.88
Manganese	2010.000	41.000	11	735.36	407.42
Nickel	224.000	44.000	8	130.38	109.63
Potassium	141000.000	9000.000	7	53000.00	31870.11
Silver	3.000	2.000	3	2.67	2.62
Sodium	280000.000	6700.000	12	82241.67	43708.33
Thallium	6.000	2.000	14	3.36	3.15
Vanadium	60.000	50.000	2	55.00	54.77
Zinc	6340.000	37.000	11	2979.27	1457.09
Cyanide, Total	494.000	6.000	23	87.65	42.25
Semi-Volatiles					
1,4-Dichlorobenzene	36.000	2.000	14	8.43	6.36
1,2-Dichlorobenzene	4.000	3.000	2	3.50	3.46
Acenaphthene	0.600	0.600	1	0.60	0.60
Dibenzofuran	0.300	0.300	1	0.30	0.30
Diethylphthalate	4.000	4.000	1	4.00	4.00
bis(2-Ethylhexyl)phthalate	36.000	5.000	6	12.83	10.05

TABLE 1
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGES
WRL AREA GROUNDWATER

COMPOUND	MAX. CONC. ug/L	MIN. CONC. ug/L	# OF DETECTS*	AVG. CONC. ug/L	GEOMETRIC MEAN ug/L
Tent. Ident. Compound-BNA					
Unknown	23.000	5.900	17	11.94	11.11
Hexadecanoic Acid	10.000	10.000	1	10.00	10.00
Benzoic acid, 4-(1,1-Dimethylethyl)-	17.000	10.000	3	12.67	12.32
1,2-Benzenedicarboxylic Acid	47.000	9.300	9	18.31	16.07
Sulfur, Mol. (S8)	650.000	8.200	11	98.75	42.20
Camphor (ACN)	14.000	14.000	1	14.00	14.00
Benzamide, n,n-diethyl-3-methyl-	10.000	9.400	3	9.80	9.80
2(3H)-Benzothiazolone	30.000	11.000	6	19.00	18.01
Benzenesulfonamide, n-ethyl-4-methyl-	14.000	11.000	2	12.50	12.41
Bicyclo[2.2.1]heptan-2-one,	26.000	26.000	1	26.00	26.00
Phenol, 2,3-dimethyl-	18.000	9.300	2	13.65	12.94
Phenol, 4-(1-methylethyl)-	9.300	9.300	1	9.30	9.30
Benzamide, n-(1,1-dimethylethyl)-4 methyl-	20.000	20.000	1	20.00	20.00
Hexanedioic acid, bis (2-ethyl...)	13.000	8.400	2	10.70	10.45
Benzenesulfonamide, n-butyl-...	10.000	9.500	2	9.75	9.75
3,6-Dioxa-2,4,5,7-Tetrasilo...	17.000	17.000	1	17.00	17.00
Ethane, 1,1'-Oxybis[2-ethoxy...	8.400	8.400	1	8.40	8.40
1,3-Pentanediol, 2,2,4-trime...	15.000	15.000	1	15.00	15.00
1-Propanol, 2-(2-methoxy-1-m...	17.000	17.000	1	17.00	17.00
1-Hexene, 3,4,5-trimethyl-	9.800	9.800	1	9.80	9.80
Benzenesulfonamide, n-ethyl-	31.000	31.000	1	31.00	31.00
Pentanamide, 4-methyl-	30.000	30.000	1	30.00	30.00
Benzoic acid, 4-(1,1-dimethyl)-	14.000	14.000	1	14.00	14.00
9-Octadecenamide, (Z)-	13.000	13.000	1	13.00	13.00

TABLE 1
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGES
WRL AREA GROUNDWATER

COMPOUND	MAX. CONC. ug/L	MIN. CONC. ug/L	# OF DETECTS*	AVG. CONC. ug/L	GEOMETRIC MEAN ug/L
Benzamide, n-propyl-	29.000	23.000	2	26.00	25.83
Hexanedioic acid, mono(2-eth...	23.000	23.000	1	23.00	23.00
Tent. Ident. Compound-VOA					
Silanol, trimethyl	13.000	5.500	2	9.25	8.46
Benzene, 1,4-dichloro-	5.500	5.500	1	5.50	5.50
Furan, tetrahydro-	23.000	9.800	2	16.40	15.01
3-Pentanone, 2,4-dimethyl-	5.500	5.500	1	5.50	5.50
Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl-,(+-)-	9.800	9.800	1	9.80	9.80
Ethyl ether	130.000	5.600	12	34.72	22.69
Unknown fluorocarbon	5.100	5.100	1	5.10	5.10
Methane, chlorofluoro-	52.000	5.000	5	22.40	15.52
Methane, dichlorofluoro-	44.000	5.300	7	15.76	11.19
Methane, chlorodifluoro-	16.000	16.000	1	16.00	16.00
Ethane, 1,1'-thiobis	8.500	8.500	1	8.50	8.50
Ethane, 1,1'-[methylenebis(o...	8.900	8.900	1	8.90	8.90
Methane, thiobis-	7.200	7.200	1	7.20	7.20
Benzene, 1,2-dichloro-	16.000	16.000	1	16.00	16.00
Volatiles					
Chloromethane	4.000	4.000	3	4.00	4.00
Vinyl Chloride	98.000	0.400	44	9.38	5.12
Chloroethane	150.000	0.530	40	14.36	6.27
Methylene Chloride	20.000	1.000	9	10.56	7.12
Acetone	11.000	6.000	3	8.33	8.08
1,1-Dichloroethene	3.500	0.210	12	1.20	0.72
1,1-Dichloroethane	110.000	0.800	70	11.73	6.94
Total 1,2-Dichloroethene	160.000	1.000	33	23.23	9.92
Chloroform	11.000	11.000	1	11.00	11.00
1,2-Dichloroethane	4.100	0.230	30	1.57	1.10
1,1,1-Trichloroethane	37.000	0.210	38	5.65	3.33
Carbon Tetrachloride	8.000	0.200	7	1.63	0.67
Bromodichloromethane	0.240	0.240	1	0.24	0.24
1,2-Dichloropropane	11.000	0.470	42	4.50	3.13
Trichloroethene	160.000	0.160	62	11.92	4.85
Dibromochloromethane	0.440	0.240	3	0.36	0.35

TABLE 1
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGES
WRL AREA GROUNDWATER

COMPOUND	MAX. CONC. ug/L	MIN. CONC. ug/L	# OF DETECTS*	AVG. CONC. ug/L	GEOMETRIC MEAN ug/L
Benzene	17.000	0.500	46	3.18	2.05
trans-1,3-Dichloropropene	2.800	0.440	5	1.17	0.89
Bromoform	0.490	0.490	1	0.49	0.49
Tetrachloroethene	75.000	0.500	52	9.25	4.85
1,1,2,2-Tetrachloroethane	18.900	4.520	3	9.46	7.51
Toluene	3.000	0.240	7	1.54	1.15
Chlorobenzene	8.300	0.340	33	2.30	1.63
Ethylbenzene	9.000	0.240	20	1.89	1.25
Total Xylenes	50.000	1.000	3	21.33	8.66
trans-1,2-Dichloroethene	6.500	0.230	20	2.47	1.67
cis-1,2-Dichloroethene	280.000	1.500	39	44.80	21.05
1,4-Dichlorobenzene	63.000	0.930	28	9.92	5.31
m and p-Xylene	4.400	1.000	8	1.94	1.73
o-Xylene	6.100	0.450	12	2.13	1.77
1,2-Dichlorobenzene	7.400	0.140	18	1.64	0.91
1,3-Dichlorobenzene	0.440	0.440	1	0.44	0.44

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
GW Indicators					
Alkalinity	mg/l	14400.000	2600.000	30	8739.33
Chloride	mg/l	17300.000	1160.000	30	4380.67
Phenol	ug/l	12000.000	201.000	30	995.90
Sulfate	mg/l	164.000	82.000	7	109.29
Nitrate + Nitrite Nitrogen	mg/l	0.810	0.220	7	0.56
Field pH	s.u.	7.990	6.630	10	7.54
Field Conductivity	umho/cm	30700.000	6520.000	10	20352.00
Metals					
Aluminum	ug/l	123000.000	320.000	13	11404.08
Antimony	ug/l	47.200	11.000	4	29.05
Arsenic	ug/l	318.000	8.000	30	57.96
Barium	ug/l	4710.000	78.000	30	831.47
Beryllium	ug/l	7.700	0.260	2	3.98
Cadmium	ug/l	266.000	1.000	25	42.39
Calcium	ug/l	241000.000	29900.000	13	88184.62
Chromium, Total	ug/l	933.000	143.000	13	448.23
Cobalt	ug/l	154.000	56.000	10	95.60
Copper	ug/l	5720.000	25.000	10	840.80
Iron	ug/l	263000.000	4820.000	13	47486.15
Lead	ug/l	1450.000	26.000	13	249.70
Magnesium	ug/l	812000.000	30800.000	13	147353.85
Manganese	ug/l	4110.000	37.000	13	637.69
Mercury	ug/l	5.900	0.490	8	2.32
Nickel	ug/l	1130.000	323.000	13	736.85
Potassium	ug/l	1750000.000	608000.000	13	1015384.62
Selenium	ug/l	12.000	11.100	2	11.55
Silver	ug/l	21.000	1.000	5	7.40
Sodium	ug/l	3100000.000	10200.000	13	1412169.23
Thallium	ug/l	45.400	45.400	1	45.40
Vanadium	ug/l	303.000	13.500	8	76.76
Zinc	ug/l	15400.000	191.000	13	3287.77
Cyanide, Total	ug/l	6000.000	38.000	13	639.46

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE
WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Pesticides/PCBs					
Alpha-BHC	ug/l	0.059	0.059	1	0.06
Beta-BHC	ug/l	0.110	0.065	2	0.09
Delta-BHC	ug/l	0.054	0.054	1	0.05
Gamma-BHC (Lindane)	ug/l	0.086	0.086	1	0.09
Aldrin	ug/l	0.720	0.085	2	0.40
Heptachlor Epoxide	ug/l	0.160	0.160	1	0.16
Endrin	ug/l	0.130	0.130	1	0.13
Endosulfan Sulfate	ug/l	0.380	0.120	2	0.25
Gamma-Chlordane	ug/l	0.092	0.066	2	0.08
AROCLOR-1242	ug/l	6.900	2.700	8	3.91
AROCLOR-1248	ug/l	7.200	7.200	1	7.20
AROCLOR-1254	ug/l	3.800	1.800	3	2.50
AROCLOR-1260	ug/l	1.800	1.500	2	1.65
Semi-Volatiles					
Phenol	ug/l	140.000	140.000	1	140.00
1,3-Dichlorobenzene	ug/l	19.000	19.000	1	19.00
1,4-Dichlorobenzene	ug/l	27.000	22.000	3	25.33
2-Methylphenol	ug/l	140.000	27.000	4	72.75
4-Methylphenol	ug/l	200.000	30.000	3	95.00
2,4-Dimethylphenol	ug/l	310.000	33.000	7	104.57
Benzoic acid	ug/l	1200.000	1200.000	1	1200.00
Naphthalene	ug/l	50.000	6.000	7	23.71
2-Methylnaphthalene	ug/l	23.000	8.000	2	15.50
Dibenzofuran	ug/l	11.000	11.000	1	11.00
Fluorene	ug/l	17.000	17.000	1	17.00
Phenanthrene	ug/l	53.000	6.000	3	23.00
Anthracene	ug/l	2.000	2.000	1	2.00
Fluoranthene	ug/l	22.000	12.000	2	17.00
Pyrene	ug/l	9.000	9.000	1	9.00
bis(2-Ethylhexyl)phthalate	ug/l	1200.000	80.000	7	354.43
Di-n-octylphthalate	ug/l	170.000	13.000	4	69.50

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Tent. Ident. Compound-BNA					
Unknown	ug/l	4000.000	29.000	90	326.16
Heptadecane	ug/l	100.000	100.000	1	100.00
Docosane	ug/l	600.000	600.000	1	600.00
Undecane	ug/l	280.000	240.000	2	260.00
Dodecane, 2,7,10-Trimethyl-	ug/l	570.000	570.000	1	570.00
2-Propanol, 1-[2-(2-Methoxy-1-Methylethoxy)-1-Methylethoxy]	ug/l	1000.000	130.000	2	565.00
Benzoic acid, 4-(1,1-Dimethylethyl)-	ug/l	190.000	43.000	3	121.00
Decane	ug/l	140.000	140.000	1	140.00
1,2-Benzenedicarboxylic Acid	ug/l	740.000	190.000	2	465.00
Pentatriacontane	ug/l	150.000	150.000	1	150.00
Iron, tricarbonyl[N-(phenyl-...	ug/l	170.000	170.000	1	170.00
Octacosane	ug/l	720.000	140.000	3	490.00
Octane, 2,3,6-trimethyl-	ug/l	210.000	210.000	1	210.00
Sulfur, Mol. (S8)	ug/l	1700.000	140.000	3	666.67
Eicosane, 10-methyl-	ug/l	170.000	150.000	2	160.00
1-Decanol, 2-ethyl-	ug/l	480.000	480.000	1	480.00
Dodecane, 3-methyl-	ug/l	160.000	160.000	1	160.00
Tetracontane, 3,5,24-trimethyl-	ug/l	250.000	250.000	1	250.00
6,10,14-Hexadecatrien-1-ol	ug/l	460.000	460.000	1	460.00
Cyclohexanone, 3,3,5-trimethyl-	ug/l	93.000	60.000	2	76.50
Camphor (ACN)	ug/l	800.000	61.000	4	472.75
3-Cyclohexene-1-methanol, .alpha., .alpha.,4-trimethyl-, (S)-	ug/l	580.000	55.000	5	302.60
Cis-Terpin Hydrate	ug/l	270.000	49.000	5	145.80
Benzoic acid, 4-methyl-	ug/l	1200.000	120.000	6	556.67
Benzene, (1-nitropropyl)-	ug/l	460.000	74.000	3	254.67
Benzamide, n,n-diethyl-3-methyl-	ug/l	260.000	79.000	5	167.40
2(3H)-Benzothiazolone	ug/l	390.000	110.000	6	208.33
Benzenesulfonamide, n-ethyl-4-methyl-	ug/l	28.000	28.000	1	28.00

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE
RESULTS BY MATRIX AND ANALYSIS TYPE
WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Phenol, 2-[1-(4-hydroxyphenyl)-1-methylethyl]-	ug/l	250.000	220.000	2	235.00
2-hexen-1-ol, (Z)-	ug/l	250.000	250.000	1	250.00
Pentanoic acid, 4-methyl-	ug/l	1500.000	35.000	2	767.50
Hexanoic acid, 2-methyl-	ug/l	240.000	240.000	1	240.00
Heptanoic acid	ug/l	850.000	850.000	1	850.00
Benzeneacetic acid	ug/l	2900.000	590.000	2	1745.00
Benzenepropanoic acid	ug/l	2800.000	130.000	3	1140.00
2-Naphthalenemethanol, decahydro-.alpha., .alpha., 4A,8-tetramethyl-,	ug/l	200.000	200.000	1	200.00
Phenol, 3,4-dimethyl-	ug/l	220.000	110.000	2	165.00
Bicyclo[3.1.1]heptan-2-one,	ug/l	890.000	95.000	3	398.33
Benzoic acid, 3,4-dimethyl-	ug/l	220.000	150.000	2	185.00
Bicyclo[2.2.1]heptan-2-one,	ug/l	720.000	110.000	8	327.50
Phenol, 2,3-dimethyl-	ug/l	260.000	110.000	3	206.67
Phenol, 2-(1-methylethyl)-	ug/l	380.000	280.000	2	330.00
Propanedioic acid, phenyl-	ug/l	100.000	100.000	1	100.00
Phenol, 3,5-dimethyl-	ug/l	130.000	130.000	1	130.00
1,6-Octadien-3-ol, 3,7-dimethyl...	ug/l	570.000	570.000	1	570.00
3-Cyclohexene-1-methanol, .a...	ug/l	1000.000	360.000	4	647.50
Decane, 2,5,6-trimethyl-	ug/l	650.000	650.000	1	650.00
3-Heptene, 7-ethoxy-	ug/l	500.000	500.000	1	500.00
Cyclohexanol, 3,3,5-trimethyl-	ug/l	700.000	240.000	2	470.00
Octadecane, 3-methyl-	ug/l	470.000	470.000	1	470.00
Hexadecane, 3-methyl-	ug/l	480.000	480.000	1	480.00
Silane, trichlorooctadecyl-	ug/l	470.000	470.000	1	470.00
Decane, 3-bromo-	ug/l	670.000	670.000	1	670.00
Heptadecane, 2,6-dimethyl-	ug/l	170.000	130.000	4	152.50
3-Pentanol, 2,3,4-trimethyl-	ug/l	240.000	240.000	1	240.00
Hexanoic acid, 3,5,5-trimethyl-	ug/l	1300.000	160.000	2	730.00
Benzoic acid, 3-methyl-	ug/l	660.000	660.000	1	660.00
Butanoic acid, 2-methylcyclo...	ug/l	250.000	250.000	1	250.00
Benzenebutanoic acid, 2,5-di...	ug/l	210.000	210.000	1	210.00

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE
WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
1,4-Dioxane, 2-ethyl-5-methyl-	ug/l	440.000	440.000	1	440.00
13-Tetradecynoic acid, methy...	ug/l	250.000	250.000	1	250.00
Cyclohexane, [2-[(2-ethylhex...	ug/l	450.000	450.000	1	450.00
4-Octadecenal	ug/l	270.000	270.000	1	270.00
Ethanone, 1-(1-cyclohexen-1-...	ug/l	560.000	560.000	1	560.00
1(2H)-Naphthalenone, octahyd...	ug/l	220.000	220.000	1	220.00
Butanoic acid, 2-ethyl-,1,2...	ug/l	690.000	690.000	1	690.00
Butanoic acid, 3,3-dimethyl-	ug/l	400.000	400.000	1	400.00
2,7-Nonadien-5-one, 4,6-dime...	ug/l	1800.000	1800.000	1	1800.00
Hexane, 2-(hexyloxy)-5-methy...	ug/l	540.000	540.000	1	540.00
.beta.-d-glucopyranoside, me...	ug/l	1100.000	1100.000	1	1100.00
Cyclohexanol, 4-(1-methyleth...	ug/l	500.000	500.000	1	500.00
4-Heptanol, 3,4-dimethyl-	ug/l	570.000	570.000	1	570.00
14-Pentadecynoic acid, methy...	ug/l	180.000	180.000	1	180.00
3-Benzofurancarboxylic acid,...	ug/l	230.000	230.000	1	230.00
1-Heptanol, 2-propyl-	ug/l	180.000	180.000	1	180.00
Phenol, 3-(1-methylethyl)-	ug/l	76.000	76.000	1	76.00
Bicyclo[2.2.1]heptane, 2,5-di...	ug/l	270.000	77.000	2	173.50
Cyclohexane, (1,1-dimethylpr...	ug/l	80.000	80.000	1	80.00
Bycyclo[3.1.1]heptane-2-carb ...	ug/l	100.000	100.000	1	100.00
Benzene, 2-methoxy-1,3,4-tri...	ug/l	77.000	77.000	1	77.00
3-Heptyne, 5,5-diethyl-...	ug/l	130.000	130.000	1	130.00
Methanone, [4-(1,1-dimethyle...	ug/l	100.000	100.000	1	100.00
Nonadecane, 2,3-dimethyl-	ug/l	87.000	87.000	1	87.00

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Benzenemethanol, .alpha.,.al...	ug/l	180.000	180.000	1	180.00
Phenol, 3-propyl-	ug/l	200.000	200.000	1	200.00
.Alpha.-santalol	ug/l	390.000	390.000	1	390.00
Decane, 4-methyl-	ug/l	170.000	170.000	1	170.00
6-Octen-1-ol, 3,7-dimethyl-	ug/l	150.000	150.000	1	150.00
4-Nonenal, (E)-	ug/l	160.000	160.000	1	160.00
Undecane, 5-ethyl-	ug/l	140.000	140.000	1	140.00
Oxirane, tetradecyl-	ug/l	460.000	460.000	1	460.00
Propanedioic acid, dimethyl-	ug/l	26.000	26.000	1	26.00
Cyclohexanol, 1,1'-dioxybis-	ug/l	49.000	49.000	1	49.00
Butanoic acid	ug/l	86.000	86.000	1	86.00
Butanoic acid, 2-methyl-	ug/l	48.000	48.000	1	48.00
Hexanoic acid, (DOT)	ug/l	94.000	94.000	1	94.00
2-Pyrrolidininone, 1-methyl-	ug/l	71.000	71.000	1	71.00
2-Propanol, 1-[2-2(2-methoxy-...	ug/l	270.000	270.000	1	270.00
Benzeneacetic acid, .alpha.-	ug/l	140.000	140.000	1	140.00
Cyclopentasiloxane, decameth...	ug/l	240.000	240.000	1	240.00
Hexadecane, 7-methyl-	ug/l	110.000	110.000	1	110.00
Heptadecane, 2-methyl-	ug/l	100.000	100.000	1	100.00
4-Hexenoic acid, 3-methyl-2,...	ug/l	150.000	150.000	1	150.00
Cholestane, 4,5-epoxy-, (4.A...	ug/l	160.000	160.000	1	160.00
Cholestan-3-one, 4,4-dimethy...	ug/l	160.000	160.000	1	160.00
Tent. Ident. Compound-VOA					
Unknown	ug/l	120.000	12.000	6	36.17
Silanol, trimethyl	ug/l	74.000	19.000	11	48.45
4-Penten-2-ol	ug/l	51.000	44.000	2	47.50
Furan, tetrahydro-	ug/l	230.000	11.000	12	80.50
2-Butanol, 3-methyl-	ug/l	160.000	140.000	2	150.00
2-Butanone, 3-methyl-	ug/l	110.000	6.900	5	48.78
2-Pentanol, 4-methyl-	ug/l	25.000	24.000	2	24.50
3-Pentanone, 2,4-dimethyl-	ug/l	28.000	5.600	9	17.99

TABLE 2
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE
RESULTS BY MATRIX AND ANALYSIS TYPE
WRL LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Leachate (Rounds 1, 2, 3, 4 and 5)

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Benzene	ug/l	7.600	1.000	17	3.89
4-Methyl-2-Pentanone	ug/l	1600.000	43.000	3	1014.33
2-Hexanone	ug/l	260.000	39.000	4	151.00
Tetrachloroethene	ug/l	17.000	0.700	2	8.85
Toluene	ug/l	730.000	18.000	27	148.47
Chlorobenzene	ug/l	5.000	0.270	9	1.95
Ethylbenzene	ug/l	77.000	1.000	21	30.11
Styrene	ug/l	10.000	0.610	12	4.28
Total Xylenes	ug/l	300.000	69.000	14	146.14
trans-1,2-Dichloroethene	ug/l	49.000	49.000	1	49.00
cis-1,2-Dichloroethene	ug/l	68.000	0.320	5	18.52
1,4-Dichlorobenzene	ug/l	30.000	5.400	9	17.43
m and p-Xylene	ug/l	103.000	1.600	12	38.88
o-Xylene	ug/l	62.000	2.700	12	32.88
1,2-Dichlorobenzene	ug/l	2.600	0.320	5	0.95

CAW/GEP

TABLE 3
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS NOT AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1 and 2)
WELLS: B15P, P3R, G115, G116, G117, G118A, G118R, G119 and G119A

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
GW Indicators					
Alkalinity	mg/l	816.000	253.000	17	383.18
Chloride	mg/l	48.000	3.000	17	21.94
Phenol	ug/l	14.000	6.000	10	9.40
Metals					
Arsenic	ug/l	40.000	4.000	4	18.50
Barium	ug/l	467.000	19.000	13	175.85
Cadmium	ug/l	9.000	0.400	4	2.60
Calcium	ug/l	194000.000	72400.000	6	102650.00
Copper	ug/l	122.000	122.000	1	122.00
Iron	ug/l	11000.000	3830.000	2	7415.00
Magnesium	ug/l	90700.000	25800.000	6	47766.67
Manganese	ug/l	2010.000	59.000	4	728.50
Nickel	ug/l	162.000	46.000	3	95.67
Potassium	ug/l	9000.000	9000.000	1	9000.00
Silver	ug/l	3.000	3.000	1	3.00
Sodium	ug/l	39200.000	6700.000	4	18975.00
Thallium	ug/l	4.000	2.000	6	2.83
Vanadium	ug/l	60.000	60.000	1	60.00
Zinc	ug/l	1450.000	37.000	6	498.33
Cyanide, Total	ug/l	494.000	14.000	4	173.50
Semi-Volatiles					
1,4-Dichlorobenzene	ug/l	4.000	4.000	1	4.00
Volatiles					
Chloromethane	ug/l	4.000	4.000	1	4.00
Vinyl Chloride	ug/l	16.000	1.900	5	8.06
Chloroethane	ug/l	30.000	1.900	4	14.40

TABLE 3
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS NOT AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1 and 2)
WELLS: B15P, P3R, G115, G116, G117, G118A, G118R, G119 and G119A

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Methylene Chloride	ug/l	19.100	18.800	2	18.95
1,1-Dichloroethene	ug/l	0.390	0.110	2	0.25
1,1-Dichloroethane	ug/l	10.700	0.140	8	3.75
Total 1,2-Dichloroethene	ug/l	2.600	1.200	2	1.90
1,2-Dichloroethane	ug/l	0.380	0.380	2	0.38
1,1,1-Trichloroethane	ug/l	3.570	0.360	6	1.31
Carbon Tetrachloride	ug/l	8.000	0.200	3	3.43
1,2-Dichloropropane	ug/l	1.190	0.510	5	0.82
Trichloroethene	ug/l	4.680	0.160	8	1.87
Benzene	ug/l	2.800	0.510	5	1.31
Tetrachloroethene	ug/l	2.500	0.480	3	1.63
Chlorobenzene	ug/l	0.680	0.680	1	0.68
Ethylbenzene	ug/l	2.130	0.280	3	1.05
trans-1,2-Dichloroethene	ug/l	0.340	0.340	1	0.34
cis-1,2-Dichloroethene	ug/l	10.100	0.200	9	5.79
1,4-Dichlorobenzene	ug/l	4.500	1.400	3	3.00

CAW/GEP

TABLE 3A
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS NOT AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 3 and 4)
WELLS: B15P, G116, G116A and P4R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
GW Indicators					
Alkalinity	mg/l	333.000	261.000	11	292.91
Chloride	mg/l	39.000	7.000	11	21.91
Phenol	ug/l	12.000	5.000	9	6.67
Sulfate	mg/l	56.000	28.000	11	35.55
Nitrate + Nitrite Nitrogen	mg/l	11.000	4.390	5	7.92
Metals					
Barium	ug/l	220.000	25.300	11	94.95
Cadmium	ug/l	2.200	0.210	8	0.93
Chromium, Total	ug/l	1.400	0.300	5	0.60
Cyanide, Total	ug/l	37.000	37.000	1	37.00
Semi-Volatiles					
bis(2-Ethylhexyl)phthalate	ug/l	13.000	9.000	2	11.00
Tent. Ident. Compound-BNA					
Unknown	ug/l	23.000	23.000	1	23.00
1,2-Benzenedicarboxylic Acid	ug/l	18.000	9.300	4	12.95
Hexanedioic acid, bis (2-ethyl...)	ug/l	13.000	8.400	2	10.70
Tent. Ident. Compound-VOA					
Benzene, 1,4-dichloro-	ug/l	5.500	5.500	1	5.50
Unknown fluorocarbon	ug/l	5.100	5.100	1	5.10

TABLE 3A
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS NOT AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 3 and 4)
WELLS: B15P, G116, G116A and P4R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Volatiles					
1,1-Dichloroethane	ug/l	4.000	1.000	7	2.86
Total 1,2-Dichloroethene	ug/l	22.000	8.000	9	13.78
1,1,1-Trichloroethane	ug/l	4.000	2.000	9	2.78
Trichloroethene	ug/l	4.000	2.000	8	2.88
Tetrachloroethene	ug/l	7.000	3.000	9	4.89

CAW/GEP

TABLE 4
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1 and 2)
WELLS: G110, G116A, MW106, P1, P4R, B15 and B15R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
GW Indicators					
Alkalinity	mg/l	1640.000	303.000	17	754.59
Chloride	mg/l	860.000	40.000	17	276.47
Phenol	ug/l	170.000	6.000	13	34.08
Metals					
Arsenic	ug/l	46.000	3.000	7	17.86
Barium	ug/l	1110.000	160.000	16	639.69
Cadmium	ug/l	8.000	0.600	3	3.17
Calcium	ug/l	126000.000	46200.000	8	96850.00
Cobalt	ug/l	84.000	63.000	2	73.50
Iron	ug/l	6230.000	253.000	5	2177.00
Lead	ug/l	37.000	6.000	3	25.00
Magnesium	ug/l	96600.000	43100.000	8	64650.00
Manganese	ug/l	1230.000	41.000	6	810.17
Nickel	ug/l	224.000	44.000	5	143.00
Potassium	ug/l	141000.000	10000.000	6	60333.33
Silver	ug/l	3.000	3.000	1	3.00
Sodium	ug/l	280000.000	11100.000	8	112425.00
Thallium	ug/l	6.000	2.000	8	3.88
Zinc	ug/l	5660.000	967.000	5	3761.40
Cyanide, Total	ug/l	193.000	6.000	7	83.57
Semi-Volatiles					
1,4-Dichlorobenzene	ug/l	12.000	5.000	4	8.50
1,2-Dichlorobenzene	ug/l	3.000	3.000	1	3.00
Acenaphthene	ug/l	0.600	0.600	1	0.60
Dibenzofuran	ug/l	0.300	0.300	1	0.30
bis(2-Ethylhexyl)phthalate	ug/l	7.000	5.000	2	6.00

TABLE 4
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGE
RESULTS BY MATRIX AND ANALYSIS TYPE
WRL WELLS AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1 and 2)
WELLS: G110, G116A, MW106, P1, P4R, B15 and B15R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Tent. Ident. Compound-BNA					
Unknown	ug/l	18.000	5.900	16	11.25
Hexadecanoic Acid	ug/l	10.000	10.000	1	10.00
Benzoic acid, 4-(1,1-Dimethylethyl)-	ug/l	17.000	11.000	2	14.00
Sulfur, Mol. (S8)	ug/l	52.000	8.200	3	36.07
Camphor (ACN)	ug/l	14.000	14.000	1	14.00
Benzamide, n,n-diethyl-3-methyl-	ug/l	10.000	10.000	1	10.00
2(3H)-Benzothiazolone	ug/l	30.000	15.000	3	20.00
Benzenesulfonamide, n-ethyl-4-methyl-	ug/l	11.000	11.000	1	11.00
Phenol, 2,3-dimethyl-	ug/l	18.000	18.000	1	18.00
Phenol, 4-(1-methylethyl)-	ug/l	9.300	9.300	1	9.30
Benzamide, n-(1,1-dimethylethyl)-4 methyl-	ug/l	20.000	20.000	1	20.00
Volatiles					
Chloromethane	ug/l	4.000	4.000	2	4.00
Vinyl Chloride	ug/l	98.000	0.950	11	12.08
Chloroethane	ug/l	150.000	0.530	13	15.85
Methylene Chloride	ug/l	15.000	15.000	1	15.00
1,1-Dichloroethene	ug/l	0.410	0.220	3	0.32
1,1-Dichloroethane	ug/l	68.000	1.900	15	11.97
1,2-Dichloroethane	ug/l	4.100	0.230	11	1.14
1,1,1-Trichloroethane	ug/l	7.900	0.210	11	4.03
Bromodichloromethane	ug/l	0.240	0.240	1	0.24
1,2-Dichloropropane	ug/l	9.600	0.470	13	3.51
Trichloroethene	ug/l	9.600	0.440	16	5.03
Dibromochloromethane	ug/l	0.240	0.240	1	0.24
Benzene	ug/l	17.000	0.830	13	4.53
Bromoform	ug/l	0.490	0.490	1	0.49
Tetrachloroethene	ug/l	8.700	0.720	10	4.20
1,1,2,2-Tetrachloroethane	ug/l	4.950	4.520	2	4.74
Toluene	ug/l	3.000	0.240	4	1.75

TABLE 4
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1 and 2)
WELLS: G110, G116A, MW106, P1, P4R, B15 and B15R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Chlorobenzene	ug/l	2.630	0.340	8	1.43
Ethylbenzene	ug/l	4.070	0.440	6	1.96
trans-1,2-Dichloroethene	ug/l	6.500	0.320	6	2.11
cis-1,2-Dichloroethene	ug/l	39.000	5.600	15	16.06
1,4-Dichlorobenzene	ug/l	16.000	0.930	11	6.08
m and p-Xylene	ug/l	4.400	1.000	6	1.94
o-Xylene	ug/l	6.100	1.670	5	2.92
1,2-Dichlorobenzene	ug/l	2.700	0.140	8	1.18
1,3-Dichlorobenzene	ug/l	0.440	0.440	1	0.44

CAW/GEP

TABLE 4A
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE
WRL WELLS AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 3 and 4)
WELLS: B15R, G110, G114, G115, P1 and P3R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
GW Indicators					
Alkalinity	mg/l	1300.000	485.000	13	846.85
Chloride	mg/l	530.000	65.000	13	261.00
Phenol	ug/l	26.000	5.000	13	11.69
Sulfate	mg/l	73.000	5.000	13	37.62
Nitrate + Nitrite Nitrogen	mg/l	0.110	0.030	6	0.06
Metals					
Arsenic	ug/l	31.700	3.300	13	15.32
Barium	ug/l	1090.000	370.000	13	681.15
Cadmium	ug/l	0.590	0.240	4	0.42
Chromium, Total	ug/l	3.000	0.400	6	1.61
Cyanide, Total	ug/l	238.000	12.000	9	75.33
Semi-Volatiles					
1,4-Dichlorobenzene	ug/l	36.000	3.000	5	12.20
1,2-Dichlorobenzene	ug/l	4.000	4.000	1	4.00
Diethylphthalate	ug/l	4.000	4.000	1	4.00
bis(2-Ethylhexyl)phthalate	ug/l	7.000	7.000	1	7.00
Tent. Ident. Compound-BNA					
Benzoic acid, 4-(1,1-Dimethylethyl)-	ug/l	10.000	10.000	1	10.00
Sulfur, Mol. (S8)	ug/l	650.000	12.000	6	157.67
Benzamide, n,n-diethyl-3-methyl-	ug/l	10.000	9.400	2	9.70
2(3H)-Benzothiazolone	ug/l	23.000	11.000	3	18.00
Benzenesulfonamide, n-ethyl-4-methyl-	ug/l	14.000	14.000	1	14.00
Bicyclo[2.2.1]heptan-2-one,	ug/l	26.000	26.000	1	26.00

TABLE 4A
SUMMARY OF MAXIMUM, MINIMUM AND AVERAGE
RESULTS BY MATRIX AND ANALYSIS TYPE
WRL WELLS AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 3 and 4)
WELLS: B15R, G110, G114, G115, P1 and P3R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Phenol, 2,3-dimethyl-	ug/l	9.300	9.300	1	9.30
Benzenesulfonamide, n-butyl-...	ug/l	10.000	9.500	2	9.75
3,6-Dioxa-2,4,5,7-Tetrasilao ...	ug/l	17.000	17.000	1	17.00
Ethane, 1,1'-Oxybis[2-ethoxy...	ug/l	8.400	8.400	1	8.40
1,3-Pentanediol, 2,2,4-trime...	ug/l	15.000	15.000	1	15.00
1-Propanol, 2-(2-methoxy-1-m...	ug/l	17.000	17.000	1	17.00
1-Hexene, 3,4,5-trimethyl-	ug/l	9.800	9.800	1	9.80
Benzenesulfonamide, n-ethyl-	ug/l	31.000	31.000	1	31.00
Pentanamide, 4-methyl-	ug/l	30.000	30.000	1	30.00
Benzoic acid, 4-(1,1-dimethyl)-	ug/l	14.000	14.000	1	14.00

Tent. Ident. Compound-VOA

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Silanol, trimethyl	ug/l	13.000	5.500	2	9.25
Furan, tetrahydro-	ug/l	23.000	9.800	2	16.40
3-Pentanone, 2,4-dimethyl-	ug/l	5.500	5.500	1	5.50
Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl-,(+-)-	ug/l	9.800	9.800	1	9.80
Ethyl ether	ug/l	130.000	5.600	10	39.06
Methane, chlorofluoro-	ug/l	52.000	5.000	5	22.40
Methane, dichlorofluoro-	ug/l	44.000	6.300	5	19.68
Methane, chlorodifluoro-	ug/l	16.000	16.000	1	16.00
Ethane, 1,1'-thiobis	ug/l	8.500	8.500	1	8.50
Ethane, 1,1'-[methylenebis(o...	ug/l	8.900	8.900	1	8.90
Methane, thiobis-	ug/l	7.200	7.200	1	7.20
Benzene, 1,2-dichloro-	ug/l	16.000	16.000	1	16.00

Volatiles

TABLE 4A
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL WELLS AFFECTED BY LEACHATE

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 3 and 4)
WELLS: B15R, G110, G114, G115, P1 and P3R

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
Vinyl Chloride	ug/l	11.000	1.000	9	3.67
Chloroethane	ug/l	37.000	1.000	9	11.78
Methylene Chloride	ug/l	3.000	3.000	2	3.00
Acetone	ug/l	11.000	8.000	2	9.50
1,1-Dichloroethane	ug/l	32.000	6.000	13	14.69
Total 1,2-Dichloroethene	ug/l	9.000	1.000	13	3.69
1,2-Dichloroethane	ug/l	4.000	2.000	3	3.00
1,2-Dichloropropane	ug/l	8.000	2.000	5	5.20
Trichloroethene	ug/l	5.000	1.000	6	2.50
Benzene	ug/l	17.000	0.600	11	3.85
Tetrachloroethene	ug/l	1.000	0.500	4	0.68
Chlorobenzene	ug/l	8.000	1.000	8	3.13
Ethylbenzene	ug/l	9.000	0.700	4	3.13
Total Xylenes	ug/l	50.000	1.000	3	21.33

CAW/GEP

TABLE 5
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL SOUTHEAST CORNER WELLS

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1, 2, 3 and 4)
WELLS: B12, B14, G109, G109A, G111, G112, G113 and G113A

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
GW Indicators					
Alkalinity	mg/l	953.000	246.000	21	680.71
Chloride	mg/l	73.000	10.000	21	31.86
Phenol	ug/l	17.000	5.000	11	8.73
Sulfate	mg/l	32.000	16.000	6	24.67
Nitrate + Nitrite Nitrogen	mg/l	11.600	0.300	3	4.36
Metals					
Arsenic	ug/l	2.700	2.000	2	2.35
Barium	ug/l	300.000	30.000	21	154.09
Cadmium	ug/l	16.000	0.200	14	1.66
Calcium	ug/l	225000.000	193000.000	2	209000.00
Chromium, Total	ug/l	3.500	0.330	3	1.45
Iron	ug/l	191.000	109.000	2	150.00
Lead	ug/l	7.000	7.000	1	7.00
Magnesium	ug/l	107000.000	72900.000	2	89950.00
Manganese	ug/l	191.000	188.000	2	189.50
Nickel	ug/l	87.000	87.000	1	87.00
Silver	ug/l	2.000	2.000	1	2.00
Sodium	ug/l	27300.000	14300.000	2	20800.00
Thallium	ug/l	3.000	2.000	2	2.50
Vanadium	ug/l	50.000	50.000	1	50.00
Zinc	ug/l	6340.000	5340.000	2	5840.00
Cyanide, Total	ug/l	15.000	8.000	3	12.00
Semi-Volatiles					
1,4-Dichlorobenzene	ug/l	9.000	2.000	3	4.67
bis(2-Ethylhexyl)phthalate	ug/l	36.000	36.000	1	36.00

Tent. Ident. Compound-BNA

TABLE 5
SUMMARY OF MAXIMUM,MINIMUM AND AVERAGE RESULTS BY MATRIX AND ANALYSIS TYPE WRL SOUTHEAST CORNER WELLS

PROJECT NUMBER: 13160.00
PROJECT NAME: WINNEBAGO RECLAMATION LANDFILL
MATRIX: Groundwater (Rounds 1, 2, 3 and 4)
WELLS: B12, B14, G109, G109A, G111, G112, G113 and G113A

COMPOUND	UNITS	MAX. CONC.	MIN. CONC.	# OF SAMPLES	AVG. CONC.
1,2-Benzenedicarboxylic Acid	ug/l	47.000	10.000	5	22.60
Sulfur, Mol. (S8)	ug/l	21.000	11.000	2	16.00
Benzamide, n-propyl-	ug/l	29.000	23.000	2	26.00
Hexanedioic acid, mono(2-eth...	ug/l	23.000	23.000	1	23.00
Tent. Ident. Compound-VOA					
Methane, dichlorofluoro-	ug/l	5.300	5.300	1	5.30
Volatiles					
Vinyl Chloride	ug/l	28.200	0.400	13	8.72
Chloroethane	ug/l	92.000	0.800	10	15.16
Methylene Chloride	ug/l	20.000	1.000	4	9.03
1,1-Dichloroethene	ug/l	1.400	0.210	3	0.71
1,1-Dichloroethane	ug/l	110.000	0.930	17	16.43
Total 1,2-Dichloroethene	ug/l	56.000	3.000	6	34.50
1,2-Dichloroethane	ug/l	1.900	0.460	5	1.58
1,1,1-Trichloroethane	ug/l	8.700	0.550	6	4.10
1,2-Dichloropropane	ug/l	11.000	0.770	13	5.08
Trichloroethene	ug/l	160.000	1.000	16	23.21
Dibromochloromethane	ug/l	0.410	0.410	1	0.41
Benzene	ug/l	4.690	0.500	11	2.22
trans-1,3-Dichloropropene	ug/l	2.800	0.440	3	1.58
Tetrachloroethene	ug/l	75.000	0.650	18	11.60
1,1,2,2-Tetrachloroethane	ug/l	18.900	18.900	1	18.90
Chlorobenzene	ug/l	4.800	0.520	10	1.89
Ethylbenzene	ug/l	3.300	0.240	5	1.22
trans-1,2-Dichloroethene	ug/l	4.990	0.230	9	2.80
cis-1,2-Dichloroethene	ug/l	280.000	9.400	11	79.07
1,4-Dichlorobenzene	ug/l	22.000	1.090	10	7.59
o-Xylene	ug/l	1.950	0.450	4	1.45
1,2-Dichlorobenzene	ug/l	3.200	0.230	7	1.06

CAW/GEP

Table 6
WRL

Validated Ambient Air Volatiles Results

Compound	Number Detects	RESULTS (mg/m3) Minimum	Maximum	ACGIH-TLVs (mg/m3) TWA	STEL
Carbon Tetrachloride	6	9.69x10-5	1.99x10-4	31	--
Chloroform	5	2.5x10 -5	7.53.10-5	49	--
Hexane	2	3.25x10-3	5.97x10-2	176	--
1,1-Dichloroethane	1	--	1.2x10 -4	810	1010
1,2-Dichloropropane	1	--	1.78x10-3	347	509
Ethylbenzene	6	1.28x10-4	2.11x10-3	434	543
p-Dichlorobenzene	6	3.09x10-5	2.59x10-4	451	661
Methylene Chloride	6	1.47x10-2	3.89x10-2	174	--
Styrene	5	5.72x10-5	1.73x10-4	213	426
Tetrachloroethene	6	2.74x10-5	1.08x10-4	339	1368
Toluene	5	8.38x10-4	1.36x10-2	337	565
Trichloroethene	6	3.46x10-5	2.04x10-5	269	1070
o-Xylene	6	1.57x10-4	1.18x10-3	434	651
m+p-Xylene	4	9.21x10-4	3.16x10-3	434	651
Isopropyl Benzene	5	1.26x10-5	4.65x10-4	246	--

Total

Maximum = 0.122 mg/m3

NAAQS - Hydrocarbons (non-methane) 0.16 mg/m3

TABLE 7

POTENTIAL ARARs
WINNEBAGO RECLAMATION LANDFILL SITE

REQUIREMENTS	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
STATE OF ILLINOIS - CHEMICAL-SPECIFIC ARARs								
1. Illinois Water Pollution Control Rules (IWPCR) - IAC Title 35, Subtitle C, Chapter 1, Part 302, Subpart B - General Use Water Quality Standards, Section 302.201 - 302.212.	X	X	X	X	X	X	X	X
2. IWPCR Part 302, Subpart C - Public and Food Processing Water Supply Standards, Section 302.301 - 302.305.	X	X	X	X	X	X	X	X
3. IWPCR Part 303, Subpart B - Non-specific Water Use Designations, Section 303.202 and 303.203.	X	X	X	X	X	X	X	X
FEDERAL - CHEMICAL-SPECIFIC ARARs								
1. Safe Drinking Water Act of 1974 (SDWA) - Maximum Contaminant Levels (40 CFR 141.11 - 141.16)	X	X	X	X	X	X	X	X
2. Federal Water Pollution Control Act (Clean Water Act) 33 U.S.C. 1251 Section 304	X	X	X	X	X	X	X	X
3. SDWA - Maximum Contaminant Level Goals (40 CFR 141.50 - 141.51)	X	X	X	X	X	X	X	X
4. CWA - Effluent Guidelines and Standards: Pretreatment Standards (40 CFR 403)	X	X	X	X	X	X	X	X
STATE OF ILLINOIS - LOCATION-SPECIFIC ARARs								
1. Designated State Highway Truck Route System for Large Vehicles and Combinations (Illinois Department of Transportation, January 1989)		X	X	X	X	X	X	X
FEDERAL - LOCATION SPECIFIC ARARs								
1. Federal Water Pollution Control Act (Clean Water Act) Section 404 - Permits for Dredged or Fill Material				X	X	X	X	X

TABLE 7

REQUIREMENTS	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
2. Guidelines for Specification or Disposal Sites for Dredged or Fill Material (40 CFR 230).				X	X	X	X	X
3. Army Corps of Engineers Permit Program Regulations (40 CFR 320-330)				X	X	X	X	X
4. 40 CFR 6 Appendix A - Statement of Procedures on Floodplain Management and Wetland Protection.				X	X	X	X	X
5. Fish and Wildlife Coordination Act et. seq.; 40 CFR 6.302.				X	X	X	X	X
STATE OF ILLINOIS - ACTION-SPECIFIC ARARs								
1. Illinois Environmental Protection Act (IEPA) Title V: Land Pollution and Refuse Disposal, Section 21 - Acts Prohibited.		X	X	X	X	X	X	X
2. IEPA - Section 21.1 - Waste Disposal Operations -- Landfill Closure and Post-Closure Fund		X	X	X	X	X	X	X
3. Illinois Solid and Special Waste Management Regulations (ISSWMR) - IAC Title 35, Subtitle G, Chapter I, Part 807, Subpart C - Sanitary Landfills, Section 807.305 (Final Cover), 807.318 (Completion or Closure Requirements)		X	X	X	X	X	X	X
4. ISSWMR Part 807, Subpart E - Closure and Post Closure Care, Section 807.501-807.524.		X	X	X	X	X	X	X
5. ISSWMR Part 809 - Special Waste Hauling, Section 809.101-809.802.				X	X	X	X	X
6. Illinois Hazardous Waste Management Regulations (HWMR) - IAC Title 35, Subtitle G, Chapter I, Subchapter A, Part 700 Subpart C - Generators, Section 700.301-700.504				X	X	X	X	X
7. HWMR, Subchapter B, Part 702 - RCRA and UIC Permit Programs, Section 702.101-702.187.				X	X	X	X	X

TABLE 7

REQUIREMENTS	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
8. HWMR, Subchapter B, Part 704 - UIC Permit Program, Section 704.101 704.149.								
9. HWMR, Subchapter C, Part 722 - Standards Applicable to Generators of Hazardous Waste, Sections 722.110-722.144				X	X	X	X	X
10. HWMR, Subchapter C, Part 723 - Standards Applicable to Transporters of Hazardous Waste, Sections 723.110-723.131				X	X	X	X	X
11. HWMR Subchapter C, Part 724 - Standards for Owners and Operators of Hazardous waste, Treatment, Storage and Disposal Facilities, Subpart B - General Facility Standards, Section 724.110-724.118.		X	X	X	X	X	X	X
12. HWMR Subchapter C, Part 724, Subpart C - Preparedness and Prevention, Section 724.130-724.137.		X	X	X	X	X	X	X
13. HWMR Subchapter C, Part 724, Subpart D - Contingency Plan and Emergency procedures, Section 724.150-724.156.		X	X	X	X	X	X	X
14. HWMR Subchapter C, Part 724, Subpart E - Manifest System, Recordkeeping and Reporting, Section 724.170-724.172, 724.176.		X	X	X	X	X	X	X
15. HWMR Subchapter C, Part 724, Subpart F - Releases from Solid Waste Management Units, Section 724.190-724.201.		X	X	X	X	X	X	X
16. HWMR Subchapter C, Part 724, Subpart G - Closure and Post Closure, Section 724.210-724.251.		X	X	X	X	X	X	X
17. HWMR Subchapter C, Part 724, Subpart N - Landfills, Section 724.400-724.417.		X	X	X	X	X	X	X
18. HWMR Subchapter C, Part 728 - Land Disposal Restrictions, Section 728.101-728.150.		X	X	X	X	X	X	X
19. HWMR Subchapter C, Part 729 - Landfill: Prohibited Hazardous Wastes, Section 729.100-729.321.		X	X	X	X	X	X	X
20. IEPA, Title III: Water Pollution, Section 12 - Acts Prohibited.		X	X	X	X	X	X	X
21. Illinois Water Pollution Control Rules (IWPCR) - IAC Title 35, Subtitle C, Chapter I, Part 302, Subpart A - General Water				X	X	X	X	X

TABLE 7

REQUIREMENTS	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Quality Standards, Section 302.101-302.105.								
22. IWPCR Part 302, Subpart B - General Use Water Quality Standards, Section 302.201-302.212.				X	X	X	X	X
23. IWPCR Part 302, Subpart C - Public and Food Processing Water Supply Standards, Section 302.301-302.305.				X	X	X	X	X
24. IWPCR Part 302, Subpart D - Secondary Contact and Indigenous Aquatic Life Standards, Section 302.401-302.410.				X	X	X	X	X
25. IWPCR Part 303, Subpart B - Non-specific Water Use Designations, Section 303.201 and 303.203.				X	X	X	X	X
26. IWPCR Part 304, Subpart A - General Effluent Standards, Section 304.101-304.141.				X	X	X	X	X
27. IWPCR Part 305 - Monitoring and Reporting, Section 305.101-305.103.				X	X	X	X	X
28. IWPCR Part 306, Subpart E - New Connections, Section 306.401-306.407.		X	X	X	X	X	X	X
29. IWPCR Part 309, Subpart A - NPDES Permits, Section 309.101-309.191.		X	X	X	X	X	X	X
30. Illinois Pretreatment Regulations (IPR) - IAC Title 35, Subtitle C, Chapter I, Part 310, Subpart B - Pretreatment Standards, Section 310.201-310.223.		X	X	X	X	X	X	X
31. IPR Part 310, Subpart D - Pretreatment Permits, Section 310.400-310.444.		X	X	X	X	X	X	X
32. IPR Part 310, Subpart F - Reporting Requirements, Section 310.601-310.634.		X	X	X	X	X	X	X
33. Illinois Effluent Guidelines and Standards - IAC Title 35, Subtitle C, Chapter I, Part 307, Subpart B - General and Specific Pretreatment Requirements, Section 307.1101-307.1103.		X	X	X	X	X	X	X
34. IEPA Title II: Air Pollution, Section 9 - Acts Prohibited.		X	X	X	X	X	X	X

TABLE 7

REQUIREMENTS	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
35. Illinois Permits and General Air Pollution Regulations (IPGAPR) - IAC Title 35, Subtitle B, Chapter I, Part 201, Subpart C - Prohibitions, Section 201.141-201.151.		X	X	X	X	X	X	X
36. IPGAPR Part 201, Subpart J - Monitoring and Testing, Section 201.281-201.283.		X	X	X	X	X	X	X
37. IPGAPR Part 201, Subpart L - Continuous Monitoring, Section 201.401-201.408.		X	X	X	X	X	X	X
38. Illinois Air Quality Standards - IAC Title 35, Subtitle B, Chapter I, Part 243, Section 243.101-243.126.		X	X	X	X	X	X	X
FEDERAL - ACTION-SPECIFIC ARARs								
1. Occupational Safety and Health Act - General Industry Standards (40 CFR Part 1910)		X	X	X	X	X	X	X
2. Occupational Safety and Health Act - Safety and Health Standards for Construction (40 CFR Part 1926)		X	X	X	X	X	X	X
3.* D.O.T. Rules for the Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-171.500)				X	X	X	X	X

Alternative 1 - No Action
Alternative 2 - No Groundwater Treatment
Alternative 3 - Off-site Treatment at POTW
Alternative 4 - On-site Air Stripping of Groundwater
Alternative 5 - On-site Air Stripping of Groundwater and Leachate
Alternative 6 - On-site Photolysis/Ozonation of Groundwater
Alternative 7 - On-site Treatment of Groundwater and Leachate (VOC/Metals Co-Removal System)
Alternative 8 - Waste Fixation (with On-Site Air Stripping)

X - Potential ARAR